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THE HEATING AND VENTILATING MAGAZINE

Vol. XI. No. 9
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NEW YORK, SEPTEMBER, 1914.

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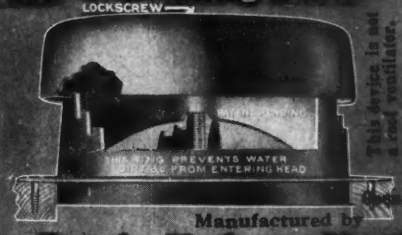

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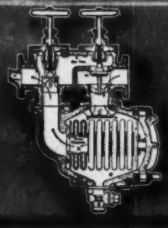

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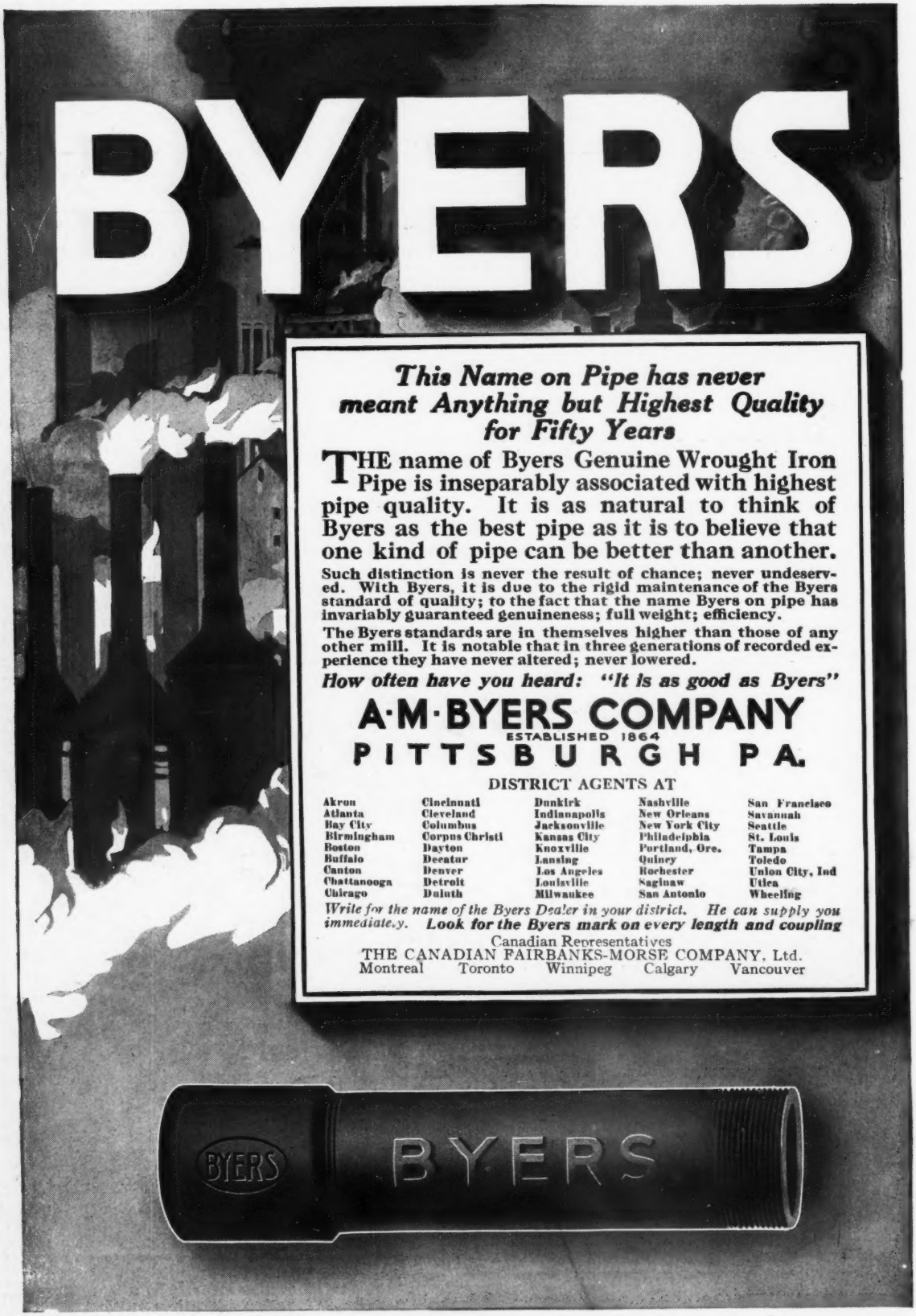

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VOL. XI. No. 9

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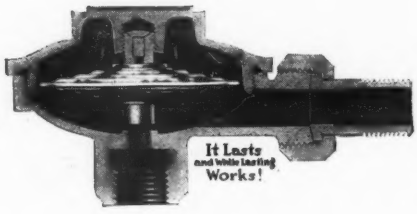

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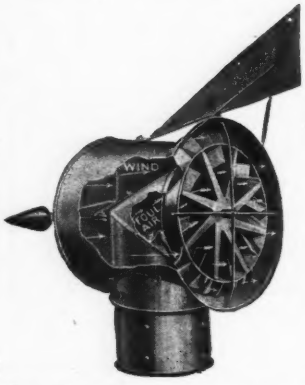

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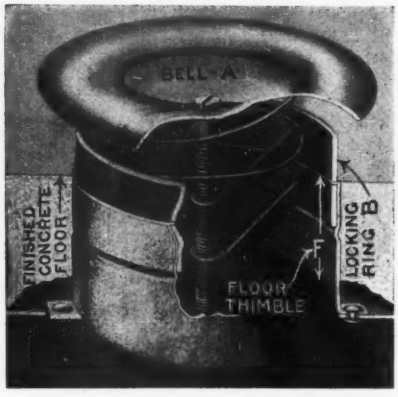

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK SEPTEMBER, 1914

Heating and Air Purifying in a Modern Machine Shop

NOVEL FEATURES OF THE SYSTEM INSTALLED AT THE FORD MOTOR COMPANY'S NEW PLANT, AT DETROIT.

BY J. H. O'BRIEN.

The present high status of shop heating as compared to older methods is well exemplified in the system installed at the Ford Motor Company's new machine shop in Detroit, Mich. This installation is well worth consideration, not only because it is one of the largest indirect heating plants ever installed, and unique in its entire design, but for other important reasons, in that it stands as the most modern example and advancement in methods of supplying heated and purified air to large buildings where a great number of men are employed. It also shows the present trend of ventilation as applied to furnishing pure and healthful air for the most efficient results from the shop men.

There is only one other factory heating system, namely, the Canadian Plant of the Ford Motor Company which embodies the features of air distribution as employed in this system. On account of the successful operation of this last-mentioned plant, it was decided to put in a similar system in the new Detroit factory. The installation under discussion has, in addition to the heating equipment, an air purifier for purifying the air and cooling during the hot season. The decision to include purifiers with the other ventilating apparatus was due in most part to the benefits derived from a cooling system which had already been put in for the general office building and the desire to make conditions in the shop as nearly ideal and pleasant as could be possible by mechanical means. Another large manufacturing concern in Baltimore, Md., has designed its new shop building to conform with this scheme and will equip the shop with complete heating, ventilating and cooling apparatus, all of which goes to show that the largest and most progressive manufacturers recognize the beneficial results of an ample supply of purified air for their employes in spite of a considerable extra first cost.

GLASS AREA 65% OF WALL SURFACE.

The building in question is constructed of steel and concrete with brick facings, and Fenestra sash. The glass area is about 65% of the wall surface. The roof is constructed of concrete covered with cinders and tar and gravel on top of this. Sky lights are built of Fenestra sash giving the maximum light area obtainable; the ends being of Hy-Rib construction. This building is six stories high, containing 11,200,000 cu. ft. of space and 939,000 sq. ft. of floor area. Fig. 1 shows these proportions and affords an idea of the exposed areas for heat losses, especially through the windows and sky lights. The heat losses

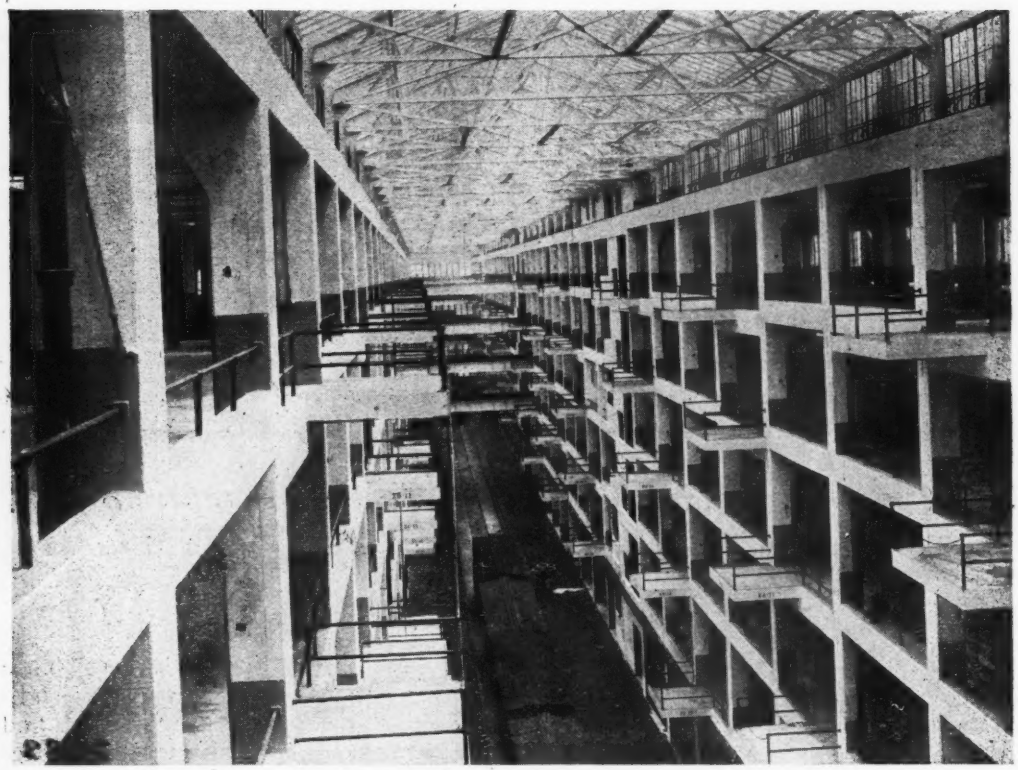


FIG. 1—VIEW SHOWING PROPORTIONS AND EXPOSED AREAS OF THE FORD MOTOR COMPANY'S NEW PLANT.

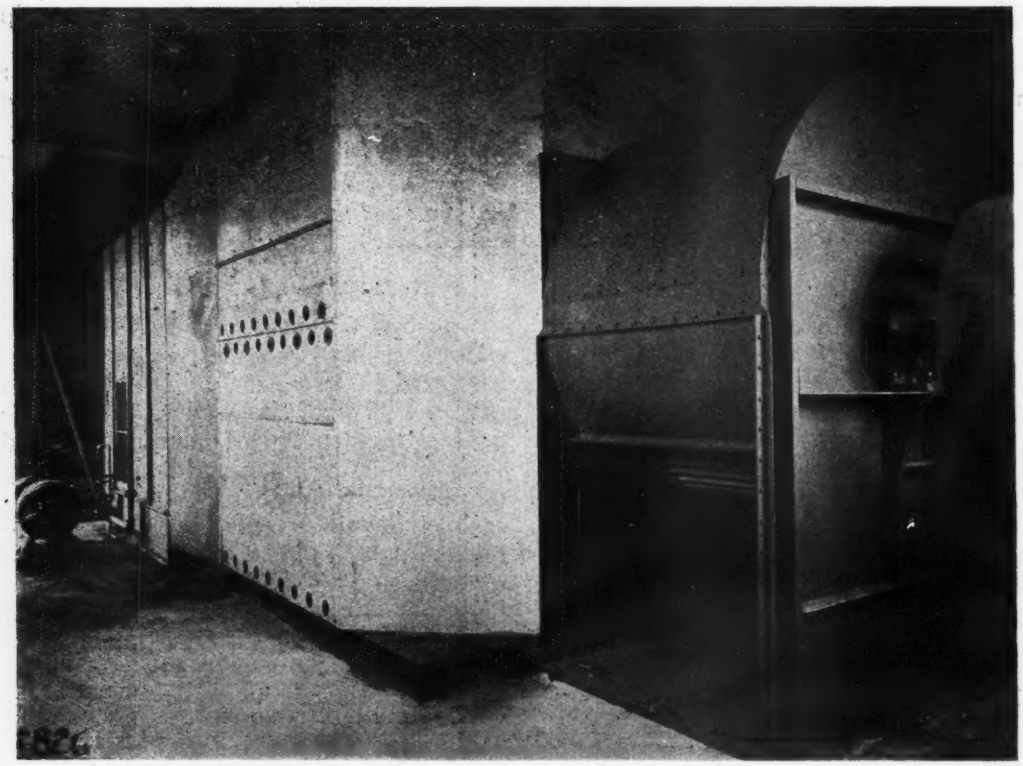


FIG. 2—HEATER, FAN AND AIR PURIFIER UNIT FOR FORD MOTOR COMPANY'S PLANT.

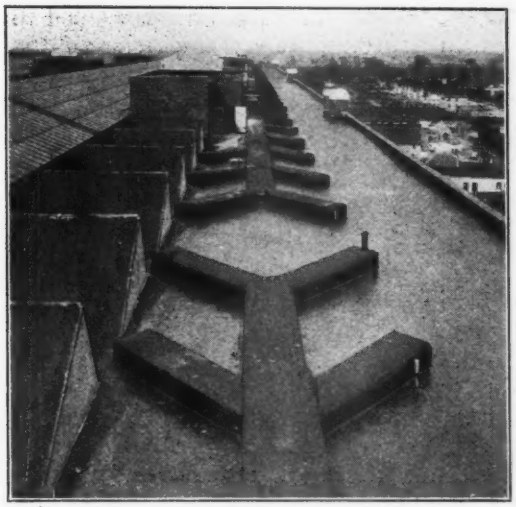


FIG. 3.—PENT HOUSES AND AIR DUCTS ON ROOF OF FORD MOTOR SHOP.

on the top floor above amount to 15,000,000 B. T. U. per hour figured at a temperature of 65° F. inside and 0° F. outside.

DESCRIPTION OF APPARATUS.

The heating, cooling and purifying apparatus consists of eight separate units, located in pent houses as shown in Fig. 3. Each unit consists of a No. 12 Sirocco left-hand, bottom horizontal discharge fan as shown in Fig. 2. This fan is 10 ft. 7½ in. high, 4 ft. 10 in. wide and has 27½ sq. ft. outlet area The fan wheel is 6 ft. in diameter and 3 ft. wide. Each fan draws through the air purifier and heater coils and discharges into the duct and hollow column system 56,000 cu. ft. air per minute.

The resistance which the fan works against is 2 in. water gauge and requires 29½ H. P. to drive. Each fan runs at 218 R. P. M. and has an efficiency of 66%. It is belted to a 40 H. P. motor.

The heater consists of nine sections deep of 72 in. Vento coil placed two stacks high and contains 10,250 sq. ft. of radiating surface. This heater is shown housed in Fig. 2. This is the largest Vento heater installation ever made.

The air purifiers are of the Sirocco type and are 11 ft. 2 in. high, 12 ft. 1 in. wide and 10 ft. 3 in. long. One of the purifiers is shown set up complete in Fig. 4. The water for this purifier is recirculated over and over, the circulation being effected by a 3 in. centrifugal pump driven by a 10 H. P. motor at

FIG. 4—ONE OF THE SIROCCO AIR PURIFIER UNITS INSTALLED IN THE FORD MOTOR COMPANY'S NEW PLANT.

1165 R. P. M. This pump handles 336 gals. of water per minute against 50 ft. head. In addition to the 49 spray heads which are seen attached to the stand pipes (Fig. 4), there are nine additional spray heads placed at the top of the washer which are used to flood the scrubbing plates. On very humid days during the hot season the spray heads are shut off entirely; thus the air is washed by passing over the flooded plates but does not take up additional moisture, as would be the case if the air were passed through a bank of mist.

Each of the eight separate equipments is installed in a pent house.

RECIRCULATION OF AIR ARRANGED FOR.

The system is designed and arranged to recirculate from each floor or to take in fresh air through the hood.

Dampers are placed in this hood or fresh air inlet and by regulating those the required volume of air is taken from the outside and the balance from the building. This proportion is regulated in accordance with the outside temperature. Since it was the intention to recirculate the air during the winter months it was not necessary to install tempering coils for heating the air before entering the washer, inasmuch as the air can be returned at a temperature sufficiently high as to eliminate any danger of freezing up the washer. This, of course, means a tremendous saving of heat and at the same time the air is kept pure due to the cleansing done as it passes through the air purifier.

In very cold weather, to effect as much saving of heat as possible, only enough fresh air is added to the recirculated air to keep up the necessary supply of oxygen for blood purification. Of course all the impurities, such as particles of dust, soot, oil and other vapors taken up by the air in its passage over the machines and workmen as well as most of the CO_2 is removed in the purifier. In this way clean and healthful air is supplied to the building, without wasting the heat already put into the air.

NOVEL DUCT SYSTEM.

The air taken through the apparatus is purified and heated to the temperature required to supply the necessary heat during cold weather, while during hot summer weather the air is cooled to within approximately one-quarter of the wet bulb temperature, and then discharged through the distributing duct system. This distributing system is novel in design and fits in nicely with the building construction. The conditioned air is discharged from each fan through a large duct which leads from the pent house onto the roof and divides into two smaller ducts going in opposite directions. Branches from each of these trunk lines in turn connect to the top of every supporting column. These ducts are constructed of concrete slab lined on the inside with plaster, 4 in. tile outside of this, 2 in. air space on the sides, another 4 in. tile wall and this again covered with plaster and roofing.

Owing to this construction the transmission losses both when heating in winter and cooling in summer are very small. At each branch line connecting to the different columns is placed an adjustable deflector of substantial construction to prevent vibration and noise. These are regulated by a rod securely fastened to the deflector and which extends through the wall of the duct. The deflectors being set to catch the proper volume of air for each column, these rods are securely fastened and closed in with cement preventing any possible leakage of air. The ducts are made of such size as to give a gradual reduction of air velocity, thus giving a constant resistance per length or span of duct, and insuring an equal distribution of air in addition to the deflector regulation.

HOLLOW BUILDING COLUMNS USED AS AIR PASSAGES.

The building columns are made hollow, being used as a passageway for the air supplied to each floor. These are made large enough in diameter to give the required area to carry the floor loads, and a hollow center of sufficient area for the air passage. When the columns were poured a permanent light gauge sheet steel duct properly centered and braced was placed inside the wood form. This duct was then filled with fine dry sand to prevent its collapse due to the pressure of the liquid concrete mixture on the outside. Air outlets on

FIG. 5—COLUMN CONSTRUCTION, FORD MOTOR COMPANY'S PLANT, SHOWING AIR OPENINGS.

each floor and from each column were provided for in the making up of the wood forms for the columns. After the concrete had set openings were made at the ground floor line and the sand removed, thus leaving a smooth air duct of the proper size within the column. Thus the air is distributed through the roof ducts and columns to the various floors. In each outlet is placed a combined diffuser and deflector, the latter being set to catch the proper volume of air for good distribution on the different floors. The column construction is shown in Fig. 5.

The outlets from the columns all point to the outside walls, the flow of air being in this direction. The return openings are along the sides of the center court, which necessitates the return of the air to this point, thus giving a complete circulation of the air across each floor.

AIR HEATED BY HOT WATER FROM GAS ENGINE JACKETS AND CONDENSERS.

The heat for the system is obtained from hot water pumped from the power house and circulated through the Vento coils. This hot water is supplied from the gas engine jackets and condenser, thus utilizing what would otherwise be waste heat. The temperature of the water can, of course, be varied according to the vacuum carried on the condenser, a high temperature being possible during severe weather. The average water is 150° F. and it was on account of this low temperature that it was necessary to install such large heaters. The velocity through the heaters is 850 ft. per minute so that the temperature of the recirculated air is raised to 115° to 120° F. leaving the heater, which is enough to heat this building in zero weather.

Air Tests in The Capitol

RESULTS OBTAINED WITH AND WITHOUT HUMIDIFYING APPARATUS.

Recent tests of the air in and about the Senate chamber and the hall of the House of Representatives of the United States Capitol building are reported by the director of the hygienic laboratory in Washington. The tests were made during April, 1914.

EQUIPMENT OF SENATE CHAMBER.

In the ventilation of the Senate chamber, the air is taken from an inlet located in a stone tower about 500 ft. to the northwest of the Capitol. Two large rotary fans draw the air through an underground tunnel. No attempt is made to cleanse or humidifv the air. From the fans the air passes through tempering coils where it is warmed and is distributed thence through distribution ducts to the Senate chamber and to the committee rooms. The distribution in the chamber is by means of ducts situated beneath the floor and through apertures in the floor. In the galleries air is distributed through the legs of the chairs. The air is removed by an exhaust fan, being drawn directly into the attic overhead and thence out through suitable openings in the roof. Short circuits are made through the opening of gallery doors so that a considerable portion of the air of the chamber is obtained from the halls and corridors of the building.

VENTILATION OF THE HOUSE OF REPRESENTATIVES.

The air supply for the hall of the House of Representatives is taken from an air court which is very clean and grassed. The tunnel to the stone tower is no longer used. The air is cleansed by being passed first through a coarse wire screen for the purpose of removing paper, leaves, etc., and then through a fine screen. Provision is made for washing and humidifying the air, also for cooling it in summer.

At the time of the investigation no use was being made of this apparatus, but the air is later passed over a small cement tank containing water for the purpose of humidification. This process of humidification is probably inefficient.

The air is warmed by passing through tempering coils and the attempt is made to maintain it at about 70° F. at this point. The distribution of the system comprises a chamber extending entirely under the floor of the House and finished in white glazed tile. It enters the hall through apertures cut through the floor and is supplied to the galleries through the hollow legs of the chairs. The exhaust system is similar to that described in the Senate chamber and the same situation as regards gallery doors and short circuiting exists. If members complain of the heat the gallery doors are fastened open.

SCOPE OF THE INVESTIGATION.

Examinations of the air were begun on the 11th of April and were continued on the 13th and 14th. Nineteen samples in all were examined. Observations made were: temperature by the wet and dry bulb from which the relative humidity is calculated; bacteria, including the total number of organisms capable of growing on nutrient gelatine at 20° C.; total number of organisms capable of growing on nutrient agar at 37° C. and number of organisms capable of producing an acid fermentation in lactose at 37°. Observations were also made of the number of duct particles per cubic foot of air.

The significance of the temperature and relative humidity values requires no discussion. The various bacterial determinations indicates in a general way the efficiency of the ventilation and the initial purity of the air supply. The number of dust particles have a similar significance.

Of the nineteen complete observations made four were made about the Senate chamber, one in the air duct leading to the Senate chamber and five in the exhaust attic above the Senate chamber. Similarly six were made about the hall of the House of Representatives, one in the duct leading to this hall and two in the exhaust attic above this hall. All the samples of exhaust air were taken during sessions. The samples from the

Senate chamber were taken before sessions as were those in the House with exception of No. 11; this was taken immediately after adjournment.

ANALYSIS OF THE RESULTS.

The results of these examinations are tabulated in the accompanying table. The values obtained for bacteria and dust particles are normal to pure air as would be expected from the large volume of air furnished, and the source of air supply. The only features of the examination which call for special comment are the temperatures and humidity values.

The normal temperature of the air entering the Senate chamber was stated to be 72° F. Observations showed the temperature of incoming air was 74° and was ranging from 74 to 77.5° F. It was stated by the engineer in charge that any lower temperature led to complaints. Temperatures in the House were maintained somewhat lower, ranging normally about 71° for the incoming air and from 75.5 to 77° F. in the exhaust air. These temperatures are all somewhat higher than is usually considered necessary or desirable. References to the corresponding relative humidities, coupled with the fact that large volumes of air are passing through both these chambers explains the apparent discomfort of the cooler air and the necessity for maintaining these higher temperatures.

LOW HUMIDITIES NOTED.

The air enters the Senate chamber with relative humidity of 29 to 33% and leaves it (on another day) at humidities of from 20 to 29%. In the House the incoming air had humidities of from 33 to 51% and the exhaust air from 26 to 32%. The lower humidity (relative) of the exhaust air in both cases is due in small part to the higher temperature of this air, but probably indicates also a considerable addition to dryer air from the heated corridors. It is noticeable that in the Senate chamber, where no provision for humidification is made and where the relative humidities are noticeably lower, a higher temperature has to be maintained for comfort than in the House with its somewhat higher humidities.

The report concludes with the following recommendations:

"It is respectfully suggested that temperatures not over 70° F. in the incoming air with relative humidities of approximately 40% would provide conditions of much greater apparent comfort than those which are now maintained, especially in the Senate chamber. Some provision for humidifying the air supply with automatic apparatus for the control of both temperature and humidity and self-recording thermographs and hygrographs would greatly simplify the operation of the system, make the conditions much more uniform and satisfactory, and furnish a permanent record of actual conditions maintained. It should never be necessary to resort to the opening of the corridor doors for the purpose of cooling the chambers as it is impossible to control the system of heating and ventilation under the variable conditions that are thus imposed."

RESULTS OF AIR EXAMINATION AT U. S. CAPITOL BUILDING.

No.	Date	Time	Temperature Deg. F.	Relative humidity Per Cent.	Bacteria per cu. ft. at 37°C. Total	Bacteria per cu. ft. at 37°C. Acid	Bacteria per cu. ft. at 20°C. Total	Dust particles per cu. foot
1	4-11	2:07 P.M.	74	29	10	0	30	208,000
2	4-11	2:28 P.M.	74	29	0	0	20	351,333
3	4-11	2:45 P.M.	74	33	0	0	15	461,333
4	4-11	3:05 P.M.	74	31	0	0	10	331,333
5	4-13	10:45 A.M.	71	33	55	0	5	371,333
6	4-13	11:05 A.M.	71	41	35	0	30	364,000
7	4-13	11:20 A.M.	71	41	30	0	20	487,000
8	4-13	6:00 P.M.	58	51	25	0	20	386,000
9	4-13	6:15 P.M.	71	33	10	0	5	385,333
10	4-13	6:35 P.M.	71	41	475	475	0	321,000
11	4-13	6:48 P.M.	71	41	—	—	15	484,666
12	4-14	1:05 P.M.	75.5	32	5	0	5	504,000
13	4-14	1:25 P.M.	77	26	15	10	115	534,000
14	4-14	2:10 P.M.	55	43	0	0	15	324,333
15	4-14	2:25 P.M.	76	22	5	0	20	312,000
16	4-14	2:45 P.M.	76	22	15	0	10	424,000
17	4-14	3:00 P.M.	77.5	20	110	0	30	324,000
18	4-14	3:15 P.M.	74	29	10	0	10	434,000
19	4-14	3:25 P.M.	74	29	5	10	35	504,000

DESCRIPTIVE NOTES REFERRING TO TABLE OF ANALYSIS.

Samples Nos. 1, 2, 3 and 4, from various points about the Senate chamber. Five persons on the floor, visitors moving about in the galleries. No session of the Senate. Heating and ventilating conditions operating normally. Average temperature 74° F. Relative humidity 31%.

Samples Nos. 5, 6, 7, 9 and 10 taken at various points about the hall of the House of Representatives. Pages and others walking about the room, visitors in the galleries. The House not in session. Average temperature 71° F. Relative humidity 38%.

Sample No. 8 taken from air duct leading to the House. Average temperature 58° F. Relative humidity 51%.

Sample No. 11 taken in the rear of the hall of the House of Representatives just after adjournment. Average temperature 71° F. Relative humidity 41%.

Samples 12 and 13 taken in the exhaust attic above the House about one hour after the opening of the session. Average temperature 76° F. Relative humidity 29%.

Sample No. 14 taken from the air duct leading to the Senate chamber. Average temperature 55° F. Relative humidity 43%.

Samples Nos. 15 to 19 taken from the exhaust attic above the Senate during a session. Average temperature 75.5° F. Relative humidity 24%.

Piping Troubles in Steam Heating Work

DIFFICULTIES EXPERIENCED IN CHANGING OVER A STEAM HEATING SYSTEM FROM GRAVITY TO VACUUM.

BY T. W. REYNOLDS.

(*Concluded from August Issue.*)

At the extreme end of the main return which is under the Express Company's offices, only one differential valve had been installed controlling all the returns in the immigrant waiting room and those on both floors of the Express Co. The photograph (Fig. 14) shows how another differential valve was installed to obtain better results. The way these returns were formerly connected is shown by the plugged elbow. The shut off valve is supposed to be located between the differential valve and the main return in order that the weights in the differential valves may be adjusted without the loss of vacuum in the main return which would result from the entering air. In this instance the valve had been located the reverse.

Two returns about 1 ft. apart and parallel to one another continued down the center of the general waiting room under the floor to the main return. These were not connected together and run as one as there is a floor beam separating the two. The sketch (Fig. 15) shows how this might have been accomplished by connecting the two together with a line dropping under the beam and another going over the top as an air line.

A gate valve each side of the differential valve would be a great convenience when one of these valves need attention while steam is on the system, otherwise a number of valves on steam mains must be turned off and the rooms left cold. The pipe fitters do not turn

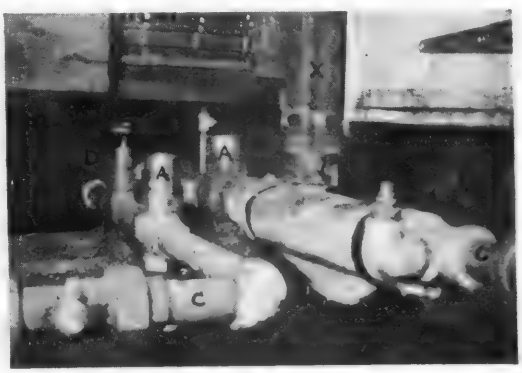


FIG. 14—IMPROVING CONDITIONS AT EXTREME END OF MAIN RETURN BY INSTALLATION OF ADDITIONAL DIFFERENTIAL VALVE.

A—Differential Valve. C—Branch Return.
B—Glove Valve. D—Main Rehurn.

the steam off but remove the caps from the differential valves while steam is on, and consequently to escape from being scalded by the hot water and the slight amount of steam present, are apt to replace the interior with its weights too hurriedly for its proper operation, or else avoid giving it any attention whatever. There are but few of these valves in any system, and they should be valved off, as this is the practice with any type of special valve. The cost would not be much as the size of valves required is small, and there are but few differential valves in any installation.

The heating during the first season the new devices were installed was not very satisfactoy, due to various causes of vacuum in the steam main may have been partially due to the condensing of the steam remaining after the main had been valved off from the boilers.

These results showed the need of a final adjustment at the differential valves. Accordingly these were weighted until the rate of flow through them could be heard working the valves at the same rate as the others along the main return, thus producing substantially the same uniform flow through each valve.

A vacuum test gauge was then placed on the main return just south of the ferry waiting room, on the pump side of all the differential valves. When this read 10½ in. or 11 in. the differential valves would be heard lifting, and as

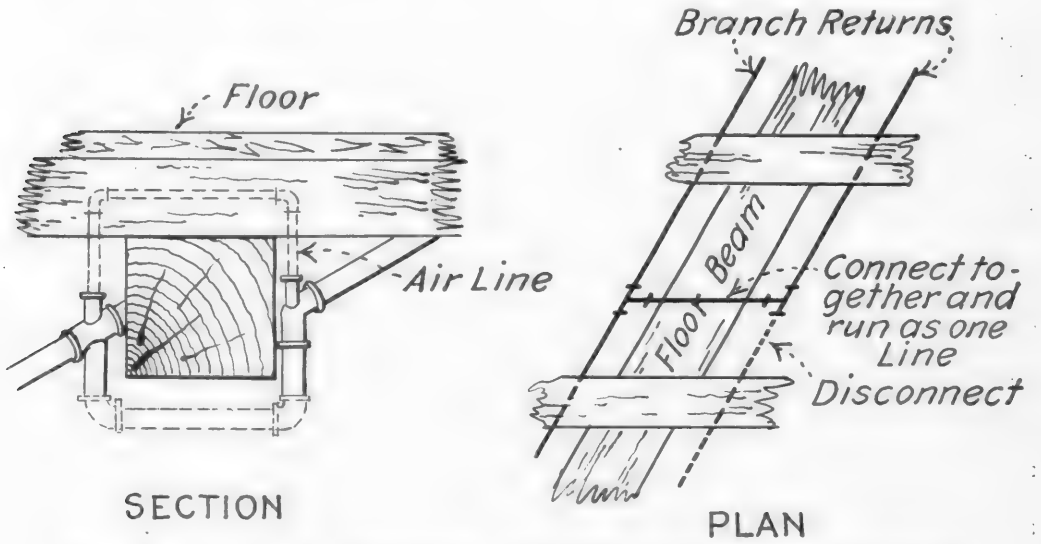


FIG. 15—METHOD OF CONNECTING RETURNS WHEN BEAM INTERVENES.

as previously outlined. In order to test out the differential valves, steam was shut off of the building and the vacuum pump was kept running. The steam gauge at the boiler house then read to 7 in. of vacuum and only 10 in. of vacuum was indicated on the gauge at the return of the pump. This was probably due to some of the differential valves not being weighted heavily enough as the difference in the readings of the two gauges was only 3 in., whereas it should have been about 13 in., or 13 in. of vacuum should have been carried on the main return when the pressure gauge read at atmosphere. The 7 in. these lifted the water could also be heard as it was picked up by the vacuum in the main return, and drawn back to the pump.

The effect of jet water on the return was tried. A vacuum of 21 in. could thus be obtained at the pump but only 8 in. of this was realized at the end of the return.

The pumps were in a pit at the boiler house and at times these were entirely under water, though this did not seem to affect their operation. After grouting up the openings into this pit it could be maintained free of water by the aid of a steam syphon.

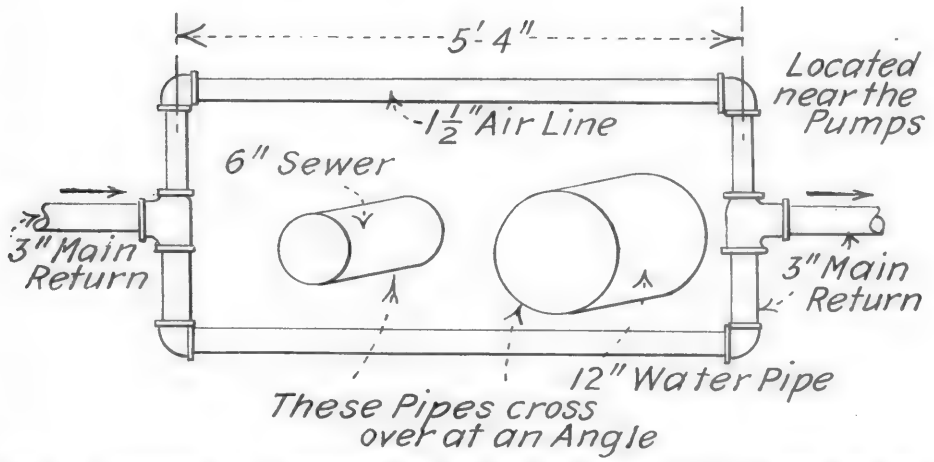


FIG. 16—SKETCH OF A POCKET IN THE MAIN RETURN NEAR THE PUMPS.

The return throughout its entire run has but a slight grade, and a number of lengths are either level or slightly graded backwards.

The old connections from the former gravity system had been left in the main return. These ended with a valve, the wheels of which had been tightened by the application of a wrench. Later it was discovered that air was being drawn into the return through the discs of these valves and this could be plainly heard. A gauge was then connected to all the other valves which appeared to be tight, and as much as 4 in. of vacuum was indicated. The valves were then removed and the tees plugged.

A globe valve was found in the main return installed in a vertical position, and was removed. No doubt this had been of use at some past time in the history of the system. The use of globe valves are objected to for reasons previously given.

A packed expansion joint was also removed from that portion of the return which extended underground to the boiler house. This was replaced by an expansion loop as shown on the drawing. Packed expansion joints frequently leak and it was noticed that after this had been removed a better vacuum was obtained.

Fig. 16 is a sketch of a pocket in the main return near the pumps. No harm can result from this arrangement. The same thing is occasionally done on other work, and parallel cases occur in this system where the branch returns in the immigrant waiting room drop at doorways with an air line carried over the doors. Trouble might have been caused by pebbles or cinders lodging in the pipe at this point, as these were sometimes found in the pump strainers. The return could have been laid to cross under these pipes and a lifting pocket provided close to the pumps. At this depth, however, the return would have been under tide water, and the effect would have been the same as that secured by the use of jet water.

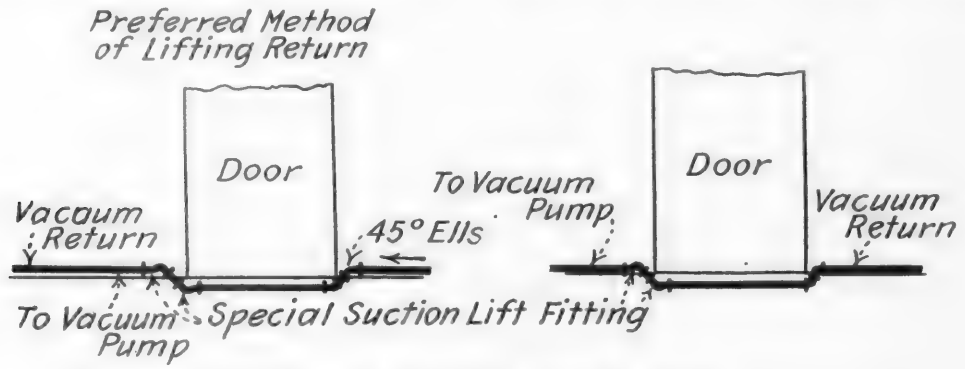
METHODS OF LIFTING RETURNS.

Various methods of lifting the returns at doorways and at other points are here shown. One manufacturer of vacuum appliances advocates a special suction lift fitting as shown in one of these sketches (Figs. 17 and 18).

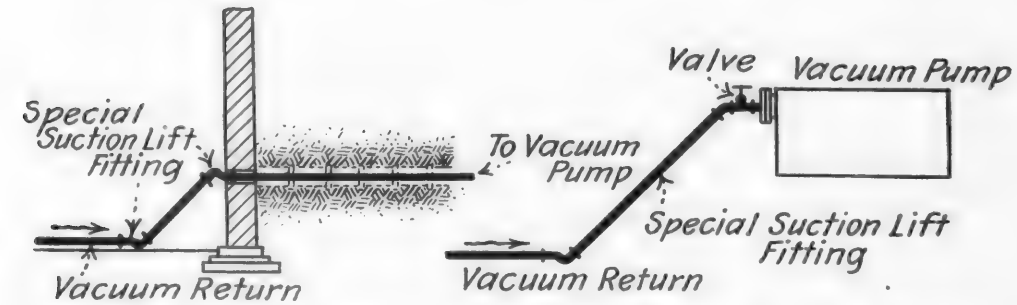
When the expansion loop was installed a portion of the old return pipe was found in such a state of deterioration that it fell apart when handled. The line was excavated further, and a number of perforated sections removed. Air could then be distinctly heard farther along the return as it was sucked into the main. Further excavations revealed this as entering through a large opening in the lower side of the pipe where it rested on the bottom of the box into which it was laid. With the removal of the earth above the pipe, the inrushing

of air was greater as it then obtained better access to the pipe, and only 5 in. of vacuum could be maintained at the pumps.

When the tide rose it shut out the air, and salt water entered instead. The presence of salt water in the returns had been suspected before, and this, together with the fact that cinders were found in the pump strainers, led to the belief that a leak existed somewhere in the return underground. The cinder fill at this point is from anthracite coal. While it is a well-known fact that ashes should be kept clear of pipes, still there have been instances of pipe not having been affected thereby after years of service. Wherever the return pipe had rested on



METHOD OF DIPPING UNDER DOORS



METHOD OF LIFTING RETURN

METHOD OF MAKING LIFT AT VACUUM PUMP

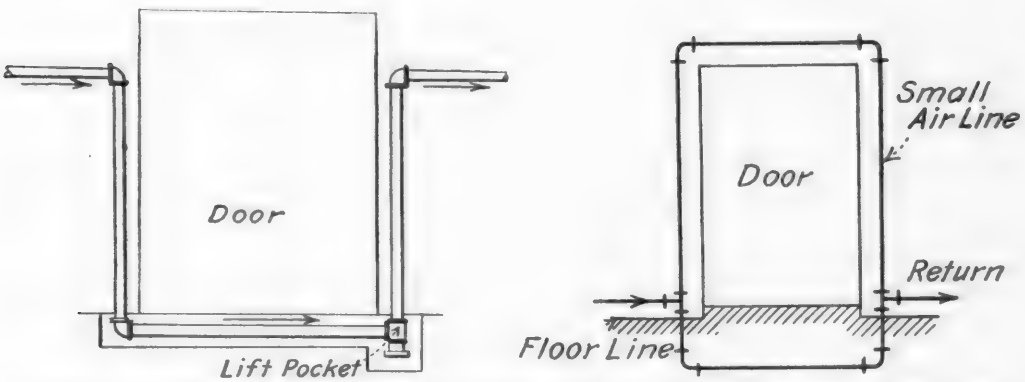


FIG. 17—VARIOUS METHODS OF LIFTING THE RETURNS AT DOORWAYS AND AT OTHER POINTS.

the bottom of the box it had corroded due to the ashes collecting at that point and coming into contact with the pipe.

Some of this pipe had a heavy coating of cinders around it. The sections which were removed had been in place about three years, but no doubt it would have lasted much longer had the main been covered, and blocked up from the bottom of the box, and the box itself dipped into tar to keep out the water.

HOW TO TELL WROUGHT IRON FROM STEEL PIPE.

Where a condition of this kind is encountered, and it is desired to ascertain whether the pipe is made of wrought iron or steel, the following instructions should be carried out.

Cut off a short piece of the pipe and suspend it in a solution of 9 parts of water, 3 parts of sulphuric acid, and 1 part of muriatic acid. First place the water in a porcelain or glass dish, adding the sulphuric and then the muriatic acid. Suspend the pipe in such a way that the end will not touch the bottom of the dish. After one to two hours' immersion remove the pipe and wash off the acid. If the pipe is steel the end will present a bright, solid, unbroken surface, while if made of iron it will show faint ridges or rings, like the year rings in a tree, showing the different layers of iron and streaks of cinder.

In order that the scratches made by the cutting off tool may not be mistaken for the circular cinder marks, it is advisable to file the end of the pipe straight across or grind on a fine emery wheel until the marks of the cutting off tool have disappeared before putting it in the acid. It sometimes happens that a bubble of gas or air has been caught in the interior of the steel ingot, which, after being rolled into skelp, will form a blister, i. e., a seam which has not been welded together. But this can easily be distinguished from the circular cinder marks referred to above by being generally visible before the pipe is immersed in the acid. When such a blister occurs in iron pipe the circular cinder marks will appear in addition to the ring mark made by the blister.

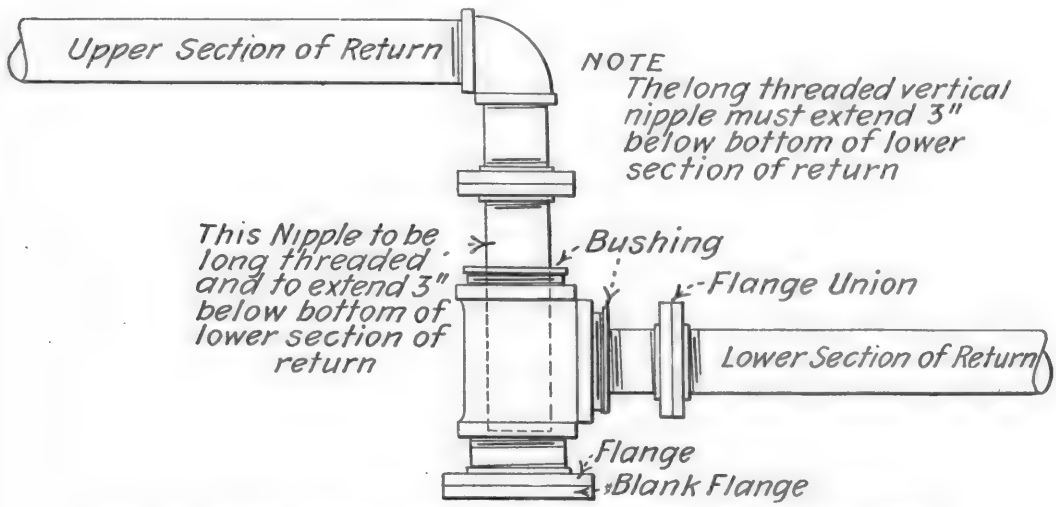

Upper Section of Return
NOTE
The long threaded vertical nipple must extend 3" below bottom of lower section of return
This Nipple to be long threaded and to extend 3" below bottom of lower section of return
Bushing
Flange Union
Lower Section of Return
Flange
Blank Flange

FIG. 18—FORM OF SUCTION LIFT FITTING FOR LIFTING RETURNS.

TROUBLES AT OVERHEAD RETURN TANK.

Trouble developed at the overhead return tank in the boiler house, incidental with the leak in the main return. The water would not flow from this tank to the feed water heater. The tank is open at the top, but some of the air was probably drawn into the line to the heater before it had time to be liberated from the water in the tank. The leak in the main return allowed large quantities of air to be drawn into the return by the vacuum pump which then discharged it to this tank. Air can not be forced

downwards, therefore any tendency of the air to bind at the elbow near the tank was relieved by being forced upwards or rising of its own accord through a small pipe which was installed

check valve or float valve at the tank failed to close. The check valve prevents the return of water at city pressure to the tank when the by-pass is in use.

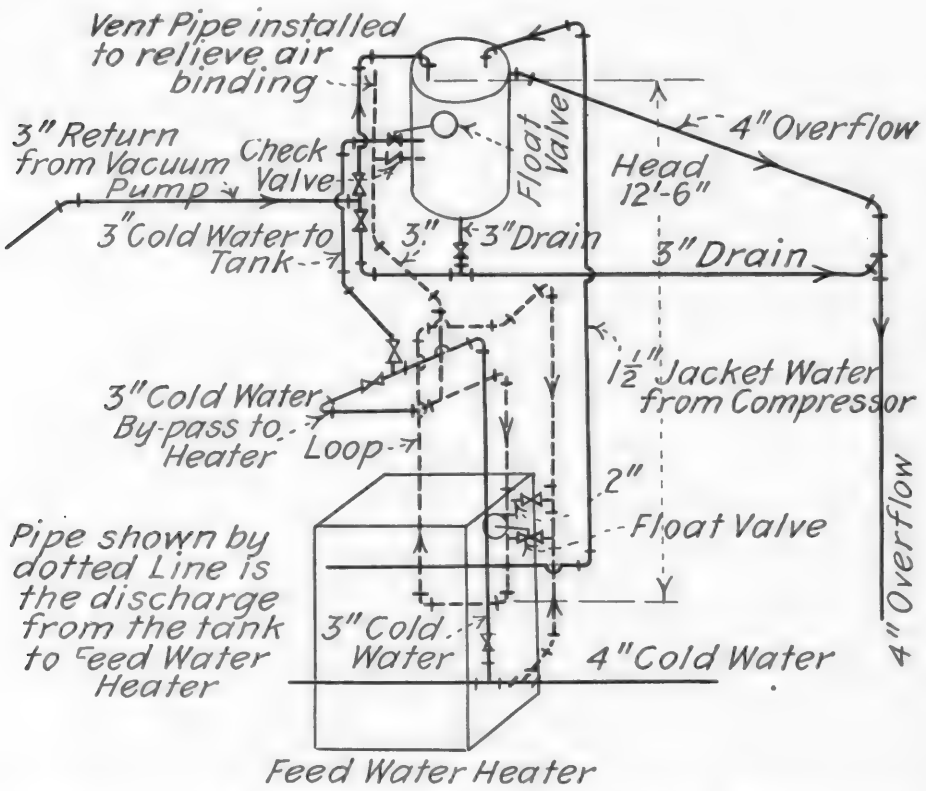


FIG. 19—METHOD OF OVERCOMING TROUBLE AT OVERHEAD RETURN TANK IN BOILER HOUSE.

to remedy this difficulty as shown in dotted lines in the sketch (Fig. 19).

The loop shown at the heater is a water seal which prevents the escape of steam from this heater, should the tank run dry. If the loop were 4 ft. in depth it would contain about 8 ft. of water which would have to be lifted by the pressure of the steam before it could escape, or (8 ft. x 0.434 lb.)= 3.472 lbs. steam pressure would lift the water seal.

Should the float valve at the heater stick, city water may be admitted directly to the feed water heater through the by-pass by opening a valve or it may be delivered to the tank through the float valve at that point. As the water is at city pressure to this tank an overflow to the sewer was provided in case the

An unusual number of fittings are present in this piping, and for this reason it was at first thought likely that the water was prevented from flowing from tank to heater, on account of the resistance offered to such flow by the fittings.

DRAINAGE TROUBLES.

Some of the branches had no provision made for drainage except through the last radiator supplied by the line. If the valve on the last radiator was closed the overhead line would soon fill up with condensation.

Where this occurs and all connections to radiators are from the side of the branch each radiator receiving an equal share of the condensation, then a ⅛-in. hole may be drilled in the seat of the valve at the last radiator supplied, in

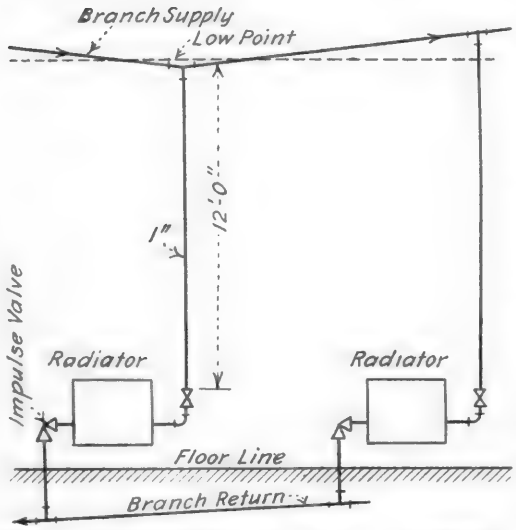


FIG. 20—CONDITION AND REMEDY WHERE SUPPLY LINE FILLED WITH CONDENSATION.

order to keep the overhead supply free of water.

An illustration is given (Fig. 20) of an actual condition, wherein a supply line which ordinarily drained itself through the radiator shown, soon became filled with condensation and its supply to the other radiator farther along its run stopped, whenever the valve at the first radiator was closed.

The drop to the radiator would fill with the condensation in 3.6 hours, due to the radiating surface in the drop itself. Practically it would have filled up within half an hour as it also received the condensation from the overhead line. Had this line been graded as shown in dotted line, and the drop to the radiator taken from the top of the line, this condition would have been avoided.

Radiators were not always distributed so as to be effective. The coil in the information bureau, which contains 11 sq. ft. of radiation, is so located that the heat from this coil rises and passes out into the general waiting room, without heating the room desired, as the prevalent drafts seem to be in that direction. A radiator at the rear of this room was added to overcome this defect. The coil was supplied by steam as shown in the sketch, and was never very warm. A better effect was obtained by running a separate supply to this coil (Fig. 21).

Pipe coils are easily thrown out of grade especially when made up of 1 in. or 1¼ in. pipe which will require supporting every few feet. Such a condition occurred in the Express Company's offices. The coil was pocketed, particularly near the supply header, at which point it finally froze up and cracked. This happened during a cold night, the exact time being determined by the chart on a recording vacuum gauge which was connected to the end of the main return near this point. As the air entered through the fractured portion of the manifold the vacuum had instantly dropped to 1 in. this being recorded on the chart.

Three radiators in the restaurant were fed by a branch which dropped below the floor with connections rising to each radiator. The line under the floor was not drained at any point in its run. This arrangement was changed by supplying these radiators with drops directly from the overhead main.

DIFFICULTY IN HEATING COILS.

The coil in the blue print room would not heat satisfactorily. The trouble at this point was due to the ¾-in. supply line which had a long run from the main, rising to the blue print room which is located on the roof. If the supply valve at the coil was kept open, the coil would heat, but once this was closed the steam would not return, as the condensation in the ¾-in. riser would be considerable

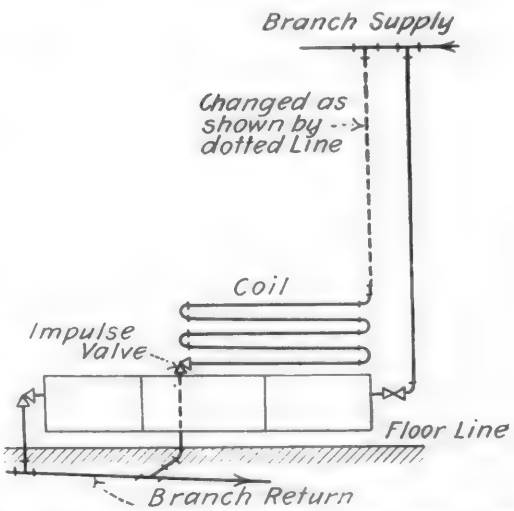


FIG. 21—REARRANGEMENT OF PIPING TO CURE COLD COIL.

when the riser was cold. This would then drain back against the flow of steam. A by-pass was installed consisting of a pipe connecting the supply and return of the radiator. If anyone should close the supply valve, the circulation would then be maintained by the by-pass. The real remedy would have been to increase the size of the riser to take care of this downward flow of condensation, but this would have been a more costly method. This coil should also have been located near the exposed wall.

Fig. 22 shows a coil of only 11 sq. ft. which was cold most of the time. The supply branch would also be cold as far as the main itself. The main is

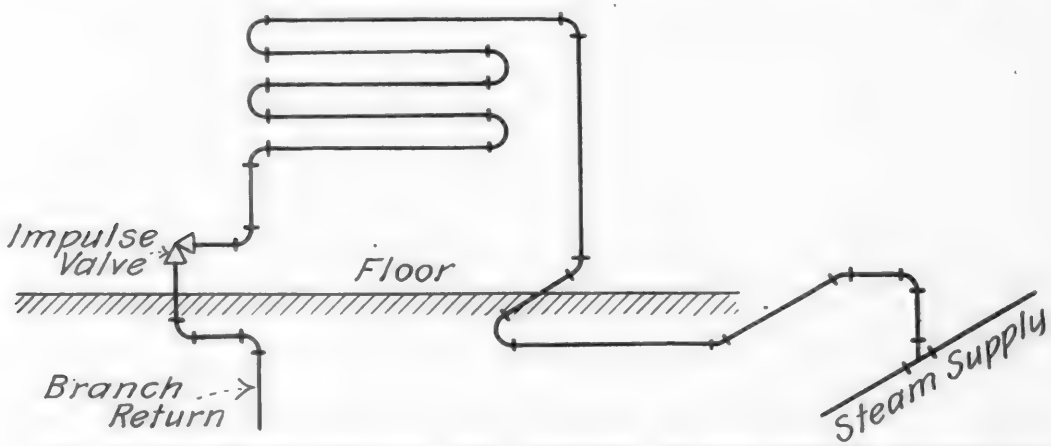


FIG. 22—HEATING OF THIS COIL WAS AFFECTED BY THE NUMBER OF FITTINGS.

2½ in., rated capacity 500 sq. ft. of radiation, but actually supplying 652 sq. ft. An unusual number of fittings are present in the supply branch and no doubt these set up considerable resistance to the flow of steam.

In this connection it is well to note that there is quite a little friction in a pipe coil of the return bend type. The friction is greater in the small sizes of pipe, as there is proportionately more of the surface in the pipe presented to the flow of steam. The fittings shown at the return end of the coil were caused by the installation of the impulse valve, but these could have been avoided, however.

The supply to the two coils in the supervisor of signals' general office had a long exposed run over the passageway. Condensation drained back against the flow of steam. Both the supply and return were slightly pocketed. The weights were removed from the impulse valves and this helped to remedy the difficulty. The greatest help, however, was that obtained in the way of a good cold day which froze these lines up and caused them to burst. As they had to be renewed, pipe of larger size was used, and the run shortened by crossing the passage diagonally.

The southwest circular radiator in the general waiting room would occasionally fill up with water. The supply branch was 1½ in., rated capacity 150 sq. ft. but actually supplying 280 sq. ft. This was connected to a 2½ in. main, rated capacity 500 sq. ft., but supplying 904 sq. ft. By closing the supply valves on two nearby radiators containing a total of 180 sq. ft. of radiation, the circular radiator would then heat satisfactorily. It is the writers opinion that when the supply to a radiator is so small that the steam can not enter the radiator as fast as it is condensed, a vacuum will then form in the radiator which will offset any vacuum which may be present in the return. This may cause the water to remain in the radiator.

The sketch (Fig. 23) shows an unusual method of piping whereby steam was obtained from several directions. The sketch pertains to the northwest and center-west circular radiators in the general waiting room. The centerwest radiator did not heat satisfactorily, but after the pipe shown in dotted line had

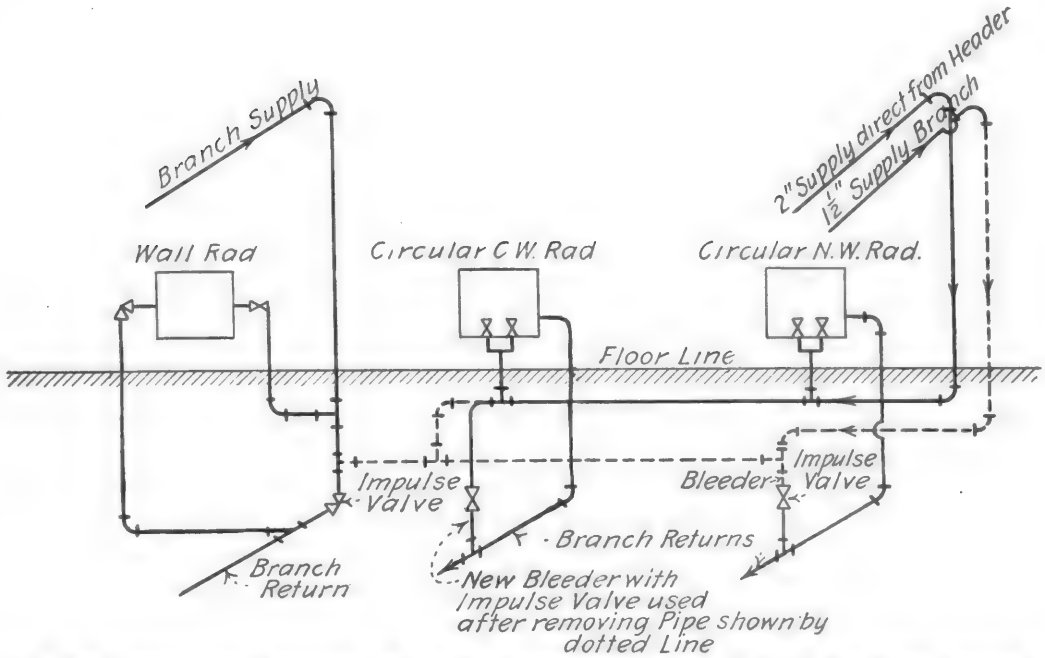


FIG. 23—UNUSUAL METHOD OF PIPING WHEREBY STEAM WAS OBTAINED FROM SEVERAL DIRECTIONS.

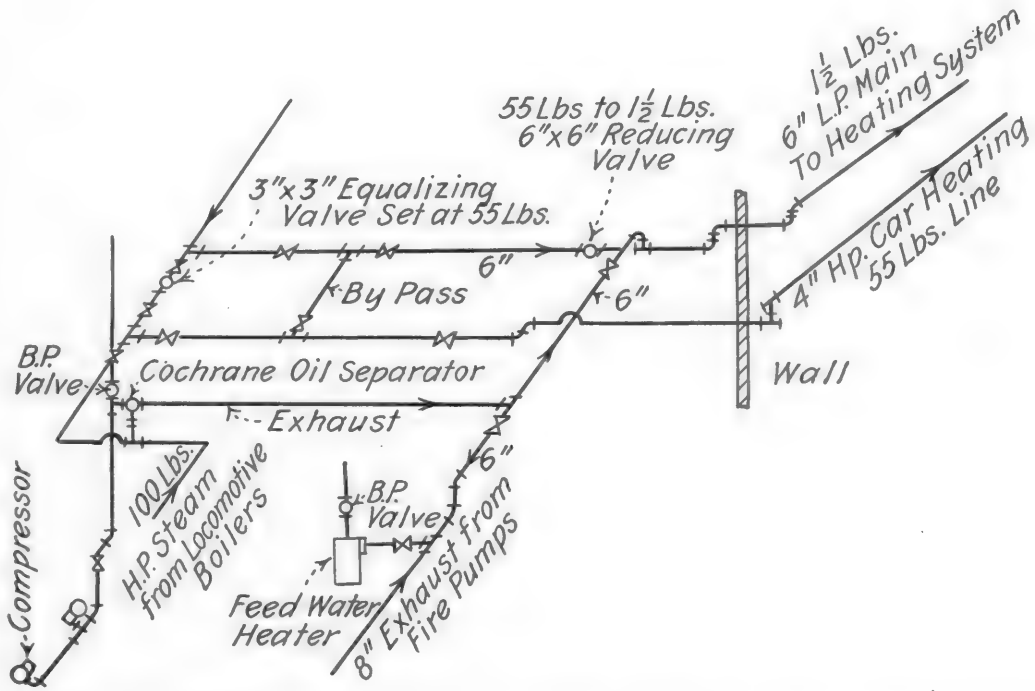


FIG. 24—ARRANGEMENT OF PIPING AT BOILER HOUSE TO OBTAIN EXHAUST AND LIVE STEAM FOR HEATING, SHOWING UNNECESSARY FITTINGS USED.

been removed, the effect was all that could be desired. The writer has a vague idea why this heated better with less supply lines than formerly, but would like to hear from readers who may have encountered a similar experience. These lines were not covered and were located under the floor where they were exposed to outside temperatures.

All other troubles were caused mainly by undersized pipes. When the supply to a radiator was reconnected to a main not overloaded the trouble would be overcome.

The General Waiting Room is 89 ft. x89 ft. in size and 44 ft. in height. The roof rises in the form of a pyramid 25 ft. above this. This room is open to the corridors of all the second floor offices. Some of the upper windows on the north side of the room would not stay closed as the counterweights pulled them partially open. These were finally kept closed by the use of blocks. No doubt a carpenter could render valuable service in overcoming the lack of heat, by similar work at other points in the terminal buildings also by the renewing of floors, etc.

The sketch (Fig. 24) shows the arrangement of piping at the boiler house to obtain exhaust and live steam for heating. Note the unnecessary fittings which were used.

The low pressure steam gauge at the boiler house was connected to the bottom of the low pressure steam main which rises at this point. The water of condensation collecting at this point creates a head of 4 ft. 7½ in. on the gauge, causing it to read (4 ft. 7½ in. x 0.434 lbs.), 2 lbs. too high. Had the connection been made as shown by the dotted line (Fig. 25) this main could

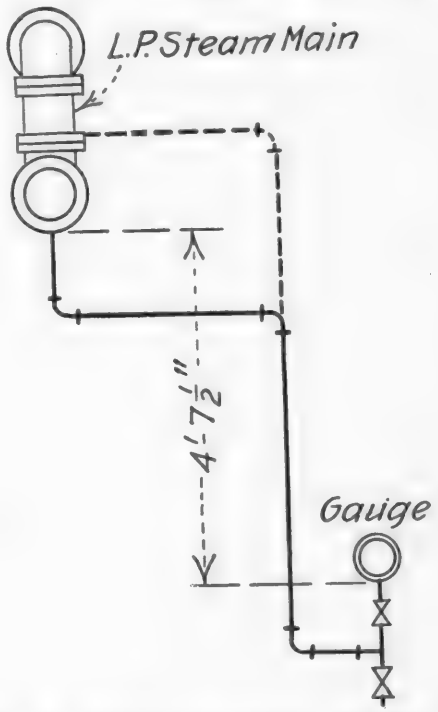


FIG. 25—WRONG AND RIGHT METHOD OF INSTALLING LOW PRESSURE STEAM GUAGE AT BOILER HOUSE.

have been kept free of condensation by occasionally opening the pet cock at the gauge. As now connected the line fills up too rapidly to allow a correct reading to be obtained.

Meter Rates for Steam in Seven States

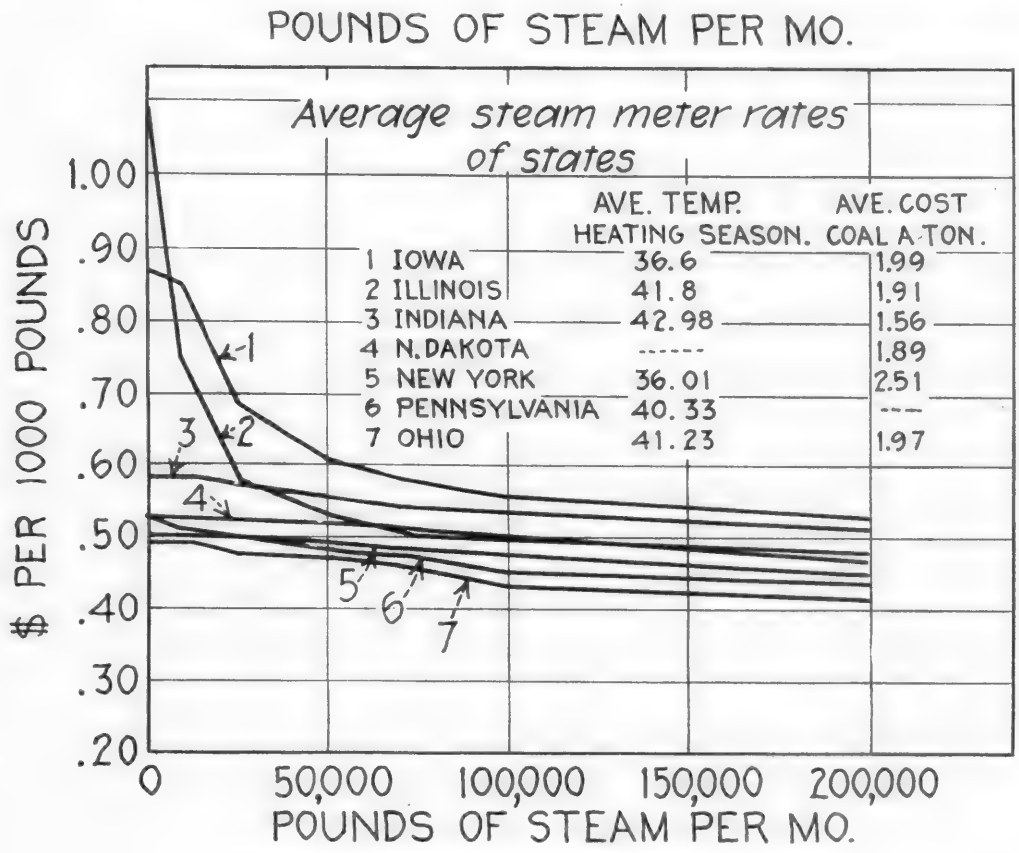
A convenient grouping of meter rates for steam in seven different States has been made by the rate committee, E. L. Wilder, chairman, of the National District Heating Association and was presented at the association's recent convention in Rochester, N. Y. It is pointed out in the report that the conditions throughout the country under which steam heating companies do business vary greatly both as to investment required, operating costs and load factor. It does not seem the province, therefore, of a rate committee to recommend any particular rates, but rather to discuss the general principles of rate making and to make recommendations as to the method of determining rates.

It is highly desirable that rates for heating be placed upon a logical basis, partially because this is being demanded more and more by the public, partially because of the rapid spread of public utility regulation, but mainly because it will develop the business along those lines which can be served with profit and discourage developments which are not economically justified.

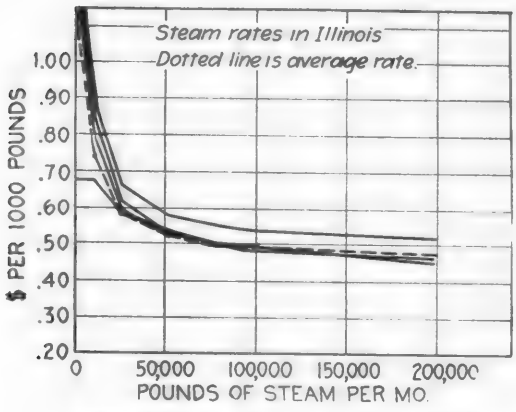
It is generally recognized that the fundamental elements entering into a rate determination are:

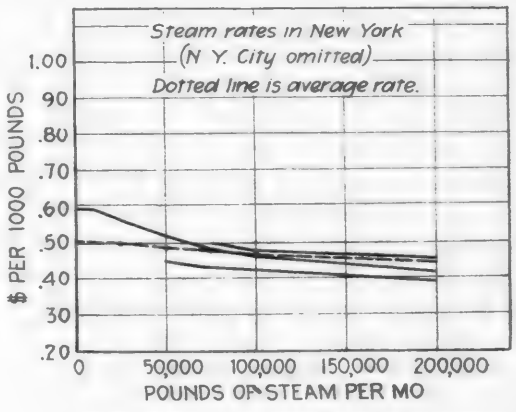
(a) Cost of service.
(b) Competitive cost.

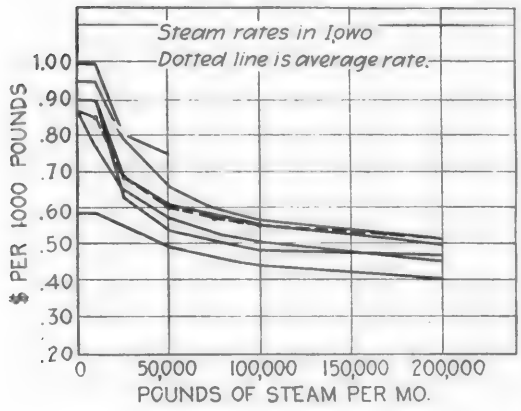
Any consideration of competitive cost must include not only the cost of coal, labor, maintenance, and fixed charges, but also the items of inconveniences, dirt, smoke nuisance, supervision, etc., which are chargeable against the privately operated plant and which are avoided by the use of central station service. The heating rate must lie be-

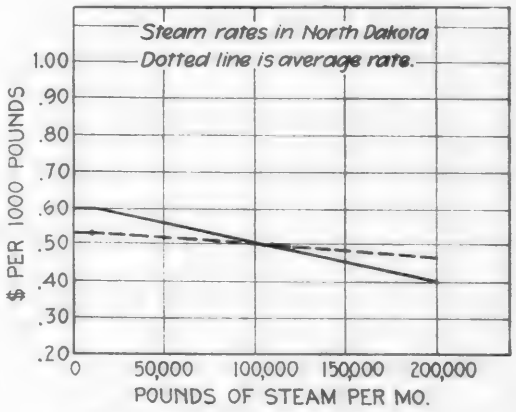


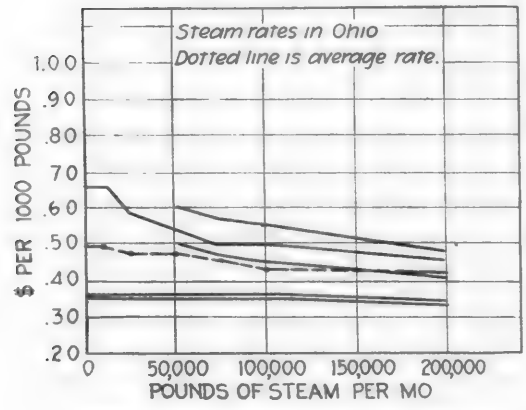
AVERAGE STEAM METER RATES IN SEVEN STATES.

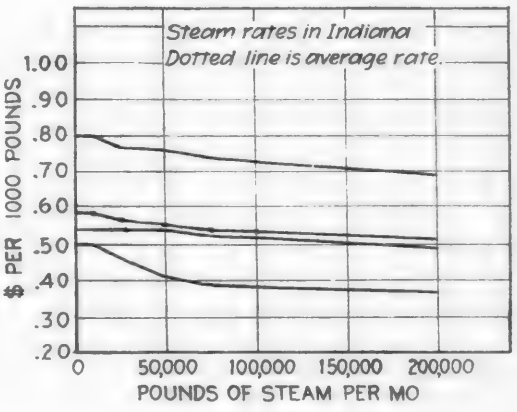


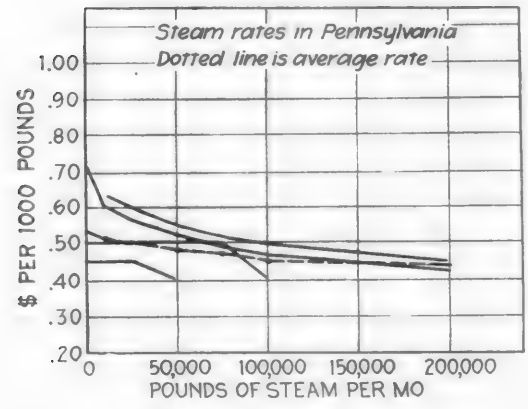












METER RATES FOR STEAM IN SEVEN STATES.

tween the cost of service and the competitive cost.

It is the opinion of the committee that rates should be determined by a careful analysis of the cost of service rendered, to which must be added a fair profit upon the capital invested.

HOW TO CLASSIFY COSTS.

While there are various methods of classifying costs, the one which the committee recommends because of its simplicity and substantial accuracy is that of dividing the total cost, including both fixed charges and operating expenses, into two parts, one of which is proportional to the maximum demand for heat made upon the system and the other is proportional to the amount of heat used. These costs plus a percentage to cover business risk and a reasonable profit determine the rates.

In the case of a hot water heating plant, because of the lack of a suitable meter for measuring the service rendered, but one charge can be made. This charge is essentially a demand charge based upon the calculated heating requirements and is the method ordinarily employed.

In the case of steam heating service the charge for steam may be divided into two parts, one a charge proportional to the steam demand and the other proportion to the amount of steam consumed.

MAXIMUM DEMAND SHOULD BE BASED ON AMOUNT OF RADIATION REQUIRED.

An inexpensive instrument for metering the maximum demand made upon the system by any customer is not available. For this reason the rate cannot at present be based directly upon the actual steam demand but must be based upon such a demand as calculation shows the customer is able and liable to throw on the system. This demand may be expressed in various terms, but the unit cost familiar to steam heating companies is that of "square feet of radiation required." The steam consumption is usually expressed in thousands of pounds. The two charge rate would then take the form of so many dollars per season per square foot of radiation required and so much per thousand pounds of steam used as shown by meter.

It is pretty generally recognized by steam heating companies that the square feet of radiation actually installed in a consumer's premises bears very little relation to the amount of steam used. For this reason it is necessary to calculate the square feet of radiation required and base the charge upon that.

The method of calculation should be made as definite and as accurate as possible and should be a matter of record. The essential factors which enter are:

1. Glass area.

Interest, Insurance, Taxes and Depreciation on:	% Chargeable to Demand or to Sq. Ft. of Radiation Required.	% Chargeable to Number of Pounds of Steam Used.
Station equipment	100	0
Distributing system	100	0
Meters and accessories	100	0
Labor (power house)	0— 50	50—100
Coal and water	.....	100
Oil, waste and supplies	.....	100
Meter reading, billing, etc	0—100	0—100
Testing and calibrating meters	0—100	0—100
Cost of repairs to:		
Station equipment	0— 50	50—100
Distributing system	0— 50	50—100
Meters and accessories	0—100	0—100
Cost of superintendence	0—100	0—100
Soliciting and advertising	0— 50	50—100
Transmission losses	0— 50	50—100

2. Exposed wall area.
3. Thickness and material of exposed walls.
4. Cubical contents.
5. Forced ventilation when used.
6. Exposure.

In the appendix is included a table giving radiation co-efficient for the various elements which enter into a building construction. This table has been used by Mr. Schott, one of your committee, for a number of years and found to be thoroughly reliable. The use of some such table of coefficients will give more accurate and consistent results than most of the formulas usually employed.

The steam demand for such apparatus as kettles, glue pots, water heaters, etc., which cannot be readily calculated, should be determined by test.

The division of the operating costs into the two groups required by a two-rate charge is a matter partially of analysis and partly of judgment. In the foregoing table is given a range of percentages which express the ideas of the different members of the committee.

There are certain loads whose maximum demand naturally comes "off-peak," such as churches and theatres. The cost of serving such is less than the cost of serving a customer whose demand comes on the peak and they can, therefore, be served at a lower rate. A reduction should be made in the demand charge for such customers, but the amount of reduction will require a careful study of the local conditions.

If a flat rate of, say, a given amount per square foot of radiation required were established for the demand charge, it would probably operate in favor of the small customer and against the large customers. It costs less to supply a given demand to one large customer than to a number of small customers, and, therefore, it is both proper and desirable to establish a sliding scale of

Co-Efficients for Estimating Radiation.

BASED ON OUTSIDE TEMPERATURE OF 10° F. BELOW ZERO AND INSIDE TEMPERATURE OF 70° F.

Single glass, loose	1.50	0.500	0.430	0.125
Single glass, medium	1.35	0.450	0.390	0.113
Single glass, tight	1.20	0.400	0.340	0.100
Double window (storm)	0.60	0.200	0.170	0.050
Vault glass (sidewalk)	1.50	0.500	0.430	0.125
Single skylight glass	1.08	0.360	0.310	0.090
Double skylight glass	0.60	0.200	0.170	0.050
Good door, half glass	0.69	0.230	0.200	0.058
Good door, solid	0.48	0.160	0.140	0.040
Poor frame wall, N. & W	0.45	0.150	0.130	0.038
Poor frame wall, S. & E	0.42	0.140	0.120	0.035
Average frame wall, N. & W.	0.42	0.140	0.120	0.035
Average frame wall, S. & E	0.38	0.130	0.110	0.032
Frame, back plastered, N. & W	0.33	0.110	0.094	0.048
Frame, back plastered, S. & E	0.30	0.100	0.085	0.025
8-in. brick wall, N. & W	0.39	0.130	0.110	0.033
8-in. brick wall, S. & E	0.35	0.120	0.100	0.029
12-in. brick wall, N. & W	0.30	0.100	0.085	0.025
12-in. brick wall, S. & E	0.27	0.090	0.077	0.023
17-in. brick wall, N. & W	0.24	0.080	0.069	0.020
17-in. brick wall, S. & E	0.22	0.070	0.060	0.018
Ceiling—floor above	0.15	0.025	0.022	0.006
Floor—not plastered beneath	0.30	0.050	0.043	0.013
Partition—plastered both sides	0.20	0.030	0.026	0.008
Cubic contents:				
Half change per hour	0.009	0.003	0.003	0.0003
One change per hour	0.018	0.006	0.005	0.0015
Two changes per hour	0.036	0.012	0.010	0.0030

charges, making the charge per unit decrease as the number of units increases.

Under the two-rate system of charging for steam, the demand charge is going to be a considerable item, and, therefore, it would seem advisable to distribute the charge over the heating months. The charge may be made the same for each month of the heating season or it may be proportioned according to the heating requirements of the various months. The following table gives a division of the demand charge which follows closely the average heating requirements.

	Percentage of Total Demand Charge
October	10
November	10
December	15
January	20
February	20
March	15
April	10

The fundamental object of a two-rate charge as presented is to fit the charge to the cost of service. As long as a customer is connected to a heating system, that system must be large enough to carry his load. Whether this load is thrown on for *one* hour or for twenty-four hours per day, those charges which are determined by the steam demand, investment in station equipment, distribution system, etc., cannot be escaped and should be paid for by a suitable demand charge. This will enable the heating companies to make more favorable propositions to those customers who have a small demand but use a large quantity of heat and who are the least expensive to serve.

Multiplying the square feet of exposure or the cubic feet of volume by the co-efficients gives the square feet of radiation required.

Co-efficients are based upon a heat transmission of 240 B. T. U. per square foot of radiating surface for vapor system and of 280 B. T. U. for a low pressure steam system.

Some Tests on the Heat Transmission of Direct Radiators at Low Differences in Temperature

ALSO ON THE HEAT TRANSMISSION FROM STEAM TO WATER IN SPECIAL FORM OF CONVERTOR.

BY J. A. DONNELLY.

(*Presented at the mid-summer meeting of the American Society of Heating and Ventilating Engineers, Cleveland, O., July* 9-11, 1914).

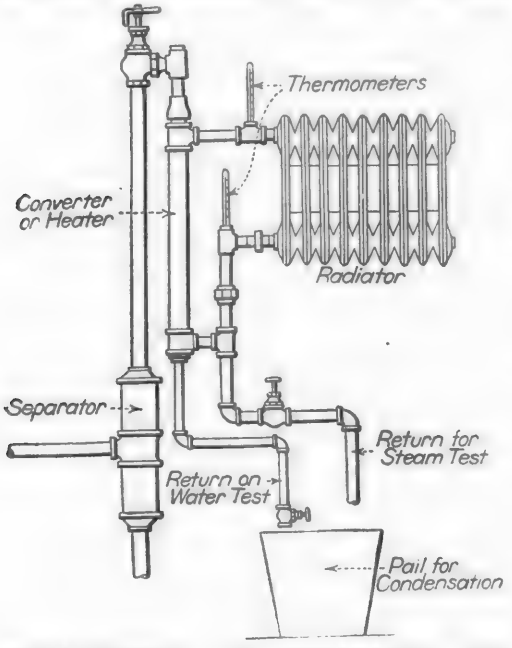
Tests of steam radiators for condensation and transmission of heat at ordinary differences in temperature of 140° to 150° F., are made with comparative ease. Tests with greater differences in temperature, even up to 300° or 350° difference, are not at all difficult if high pressure steam is available and if the type of radiator chosen is one that will stand the working pressure.

Tests at lower differences in temperature are not easily made with steam unless by the use of some special form of apparatus. Of course, it is possible to use steam at a nominal pressure and test a radiator in a room the temperature of which is extremely high. This, however, while duplicating conditions for drying rooms, does not duplicate conditions found in every day practice where the room is usually 70° and the radiator may be as low as 120° to 170°.

The apparatus as shown in the accompanying illustration was constructed in order to see if reliable tests could be made under the conditions suggested, with the thought that at some future time tests similar to these might be conducted on a larger scale. The radiator was of sheet steel, hot water type, 14 in. high, 9 sections, rated and containing practically 12 sq. ft. of surface. The convertor used for heating the water was made with a 1½ in. outside pipe and was fitted with an interior pipe varying from ¼-in. to 1 in. This pipe extended through a bushing at the bottom, the upper end terminating inside the 1½ in. pipe a short

distance above the upper connection to the radiator. The water between the two pipes circulated to and from the radiator through 1 in. connections. Thermometers were inserted in the flow and return connections, the average temperature of which was taken as the average temperatures of both the radiator and the convertor.

With a ¼-in. pipe used as the heating pipe inside the convertor, the inlet temerature of the radiator was 171° and the outlet temperature 157°, giving an average of 164°, which with the room at 72° would give a temperature difference of 92° between the room and the radiator. The steam suply was at about one pound pressure. This was throttled through the fractional valve on the inlet



ARRANGEMENT OF APPARATUS FOR TESTING RADIATORS AT LOW DIFFERENCES IN TEMPERATURE.

so that the temperature of the steam was at 212°. A small amount of steam was allowed to flow from the bottom of the convertor so that the pressure and temperature could not rise above this point, Under these conditions, the convertor and radiator condsened 2½ lbs. per hour. This multiplied by 970 B. T. U. per pound gives a total of 2,425 B. T. U. per hour, which if divided by 92 (the temperature difference) gives 26.33 B. T. U. per hour per degree difference.

The drain valve was then opened and a test was run with the convertor and the entire radiator under steam at atmospheric pressure. Under these conditions the radiator condensed 4 lbs. 6 oz. per hour, thus giving off 4343.75 B. T. U., which divided by the difference in temperature between the room 74°, and the steam, 212°, which gives a temperature difference of 138°, gives a transmission of 31.48 B. T. U. per hour per degree difference. The difference in transmission between 31.48 and 26.33 is 5.15, which divided by 31.48 would seem to indicate that the radiator gave off 16.3% less heat per degree difference in temperature, with 92° difference, than with 138° difference. In Carpenters' "Heating and Ventilating of Buildings," page 86, the transmission per square foot per degree difference is given for 140° difference at 2.48 B. T. U. and at 90° difference at 2.24 B. T. U. with 12 in. thin radiator surfaces.

From this, it would seem that the tests upon which this table was based indicate that a radiator with 90° difference in temperature would give off 10% less heat per square foot per degree difference than with 140° difference.

With ½-in. pipe inside of the convertor in place of the ¼-in., the average temperature of the radiator was increased only 8°, that of the inlet being 181° and that of the outlet, 163°. This was with a room temperature of 72°, giving a difference of 100°.

With a ¾-in. pipe in the convertor the inlet temperature was 186° and the outlet temperature, 166°, giving an average of 176°, which with a room temperature of 75°, gave a temperature difference of 101°. With a 1-in. pipe in the convertor, the inlet temperature was 188° and the outlet temperature 160°, giving an average of 174°, which with a room temperature of 75°, gave 99° difference in temperature. From these figures it would seem as if little if any advantage was gained by increasing the surface of the heating pipe. Evidently the cutting down of the area through which the water flowed between the two pipes increased the friction so that but very little benefit was gained by the increased surface.

The convertor was nominally 2 ft. 8 in. long, which gave the length of the ¼-in.

inner pipe as 2 ft. 6 in., or 0.357 sq. ft. This divided into the total, 2,425 B. T. U. gave a transmission of 6,792 B. T. U. per square foot which with a steam temperature at one side of 212° and an average temperature of the water on the other side of 164°, or 48° difference, gives a transmission from steam to water under these conditions of 141.5 B. T. U. per square foot per degree difference.

DISCUSSION.

WILLIS H. CARRIER: I understand from those who have made radiator tests that there is a great difficulty in getting standard conditions for testing or even in getting two successive tests to show corresponding results. Different types of radiators seem to vary much with respect to the nature of their surfaces and in regard to the effect which these surfaces have upon the convection factor. Another element which causes a great variation in apparent results obtained in heater tests is the difficulty in measuring the condensate accurately, owing either to entrainment of moisture in the steam supply or to evaporation from the condensate itself.

The rate of heat transmission quoted by the author is considerably higher than that customarily given for standard conditions of radiation. I think that possibly 1.7 B.t.u. per square foot per hour per degree difference in temperature would be about the average of the standard practice. Of course, if one were to take a single-pipe radiator, with perfect air circulation, etc., I suppose that the heat transmission might go up as high as 2.5 B.t.u. per square foot per degree difference in temperature, as quoted by Mr. Donnelly.

PROF. JOHN R. ALLEN: We have been carrying on radiator tests at the University of Michigan for about 20 years. Mr. Carrier is right in his statement in regard to the heat transmission, which we find varies from 1.6 to 1.7 B.t.u., the average being about 1.67 B.t.u. There are many conditions that affect that. One condition that is often lost sight of is the fact that radiation from the radiator depends upon the room itself. We used to make our radiator tests near an outside window. We changed that to a room that had a large amount of window surface. We found that the heat transmission through the radiator increased about 10 per cent. because the radiator lost heat in two ways, by convection and by radiation, and the radiation loss depends upon the temperature of certain surfaces. If there are windows surrounding the radiator the temperature of which is low, the radiation is necessarily high and that increases the radiation from the radiator.

In order to compare radiators you must have a standard room in which to compare them. You must be certain that you have dry steam when making tests with steam. In order to do that we always first superheat our steam. We use high pressure steam with a reducing pressure valve, so that we are sure to have superheat, and then we allow for the heat of the superheat in making the tests, which is a matter of one or two degrees, a small correction.

It makes a difference whether the radiators are of the two-column type and the spacing is also an important factor, also the ease with which the air can pass along the surface. If you take an ordinary two-column radiator and increase the spacing one-half inch, you will increase the heat transmission about 10 per cent. through the radiator. So that, in comparing radiators, you should know approximately the air area between the surfaces in order to get an exact comparison.

The amount transmitted is slightly affected by the moisture conditions of the air in the room. As the moisture in the room increases the heat transmission diminishes. Under extreme conditions the heat transmission will vary about 5 per cent., depending upon the moisture in the room.

There have never been laid down any standard conditions for testing radiators. This is one of the things that this society might properly take up, the establishing of rules for standard testing of direct radiators. Of course, each one of these factors is in itself small, but accumulated they show marked variations that would easily account for the differences we get in various tests. A standard room for such a purpose should be a room containing about the usual amount of window surface. If you test

a radiator in a room with a standard the same radiator in a greenhouse, you amount of window surface and then test will get a very marked difference in the total heat transmission, running as high as 20 per cent.

J. A. DONNELLY: A point brought out by Mr. Carrier is that the amount of temperature difference between the radiator and the air is not the difference between the radiator and that of the air in the room, but the difference between the radiator and the air immediately surrounding it. That can be checked by placing a thermometer below the radiator. I have made such tests and have found that, although the difference of temperature between the radiator and the room remained constant, the difference between the radiator and the air below the radiator might vary. This condition occurs when there are varying weather conditions and varying amounts of air leakage through the windows or when the temperature is affected by the adjoining rooms.

Notes on Operating a Central Station Heating Plant

A number of points relative to operating conditions which are exclusively heating and which affect the operation of a district heating station were brought out in a report of the station operating committee, Byron T. Gifford, chairman at the recent meeting of the National District Heating Association. It was shown, for example, that in a steam plant, the initial pressure required on the pipe line, or, in other words, the pressure at the station end of the pipe line is dependent on conditions existing in the pipe line and in the consumers' equipment. The insulation of the pipe line, the size of the mains, the style of the system, whether return or non-return, all affect the initial pressure required at the station. Ordinarily it is most economical to operate the exhaust steam heating line with as low a pressure as possible. The determining factor in this respect is that we must have a sufficient pressure at the consumers' service to properly fill the consumers' equipment with steam.

Ordinarily 1 lb. gauge pressure at the service entrance is sufficient to do this, and if this pressure is not sufficient to fulfill the requirements, the condition of the consumers' equipment should be investigated and the fault remedied, rather than endeavor to carry a higher pressure on the pipe line to overcome the difficulty. The insulation of the pipe line affects the pressure, and as we all know, materially affects the economy of the heating plant. The size of the mains also affects the initial pressure owing to the friction in the pipe line.

The details of the pipe line design are not taken up in this report, but it is almost impossible to operate economically unless the pipe line is properly built and designed and unless it fulfills the conditions under which it must work. As a general rule the committee recommends that the initial pressure on a steam heating system be kept as low as possible. It can be definitely stated that within certain limits, the net earnings of a heating system are inversely proportional to the initial pressure on the heating main.

THREE VITAL POINTS IN HOT WATER PLANT.

In a hot water system the heat is transmitted to the consumer by means of circulating water. This water takes on heat at the station and emits heat in the consumers' radiator. The three vital points therefore in operating a hot water plant are as follows:

The circulation of the water.
The reheating of the water.
The cooling of the water.

The first two of these belong to station operation and are discussed in this report. The first item, namely: "the circulation of the water" is affected, first, by the pipe line conditions, and second, by the circulating devices which propel the water. Radiation losses in the pipe line affects the station operating, in that it allows a greater difference in temperature between the incoming and outgoing lines. This means that a higher temperature will be required on the outgoing lines in order to give the required tem-

perature at the consumers' radiation, and this, of course, means a more expensive operation owing to the higher temperature required in the outgoing water.

Friction loss in the pipe line increases the differential pressure at the station and consequently requires greater pumping power. The grade and contour of the pipe line also affects the station operating. Owing to the laws of gravity, hot water or water heating tends to rise and cold water or water cooling tends to fall. This we know from the circulation of a gravity hot water heating system, and if, therefore, the contour of the pipe line is such that we have occasion to oppose the laws of gravity, we will add considerably more work to our circulating pumps and consequently will increase our operating costs. The cost of circulating the water in a hot water heating system may be calculated in the example given below:

EXAMPLE SHOWING COST OF CIRCULATING WATER.

Assuming an active load of 100,000 sq. ft. of hot water radiation under ordinary conditions, 6 lbs. of water per square foot of radiation per hour will transfer sufficient heat for each square foot of radiation. With a properly designed and balanced pipe line, 20 lbs. differential pressure between the flow and return mains will be sufficient differential pressure to circulate this amount of water. Our hourly load under these conditions will be raising 600,000 lbs. of water to 20 lbs. or approximately 46 ft. This shows us a total amount of work to be done of 27,600,000 ft. pounds per hour, which equals 460,000 ft. pounds per minute. One horsepower is equal to 33,000 ft. pounds per minute, therefore, the theoretical horsepower required to circulate the above mentioned quantity of water is 14. Assuming a 60% efficiency in the pump it will require 23½ H. P. at the shaft of a centrifugal pump to deliver this water. If this pump were connected to a steam turbine we could probably develop a horsepower with 50 lbs. of steam. This shows us a requirement of 39.3 boiler horsepower to operate the circulating pumps. The steam used in this circulating pump will, of course, be returned to the heating station through some of the steam reheating apparatus.

COMPARISONS OF COST WHEN CIRCULATING STEAM.

Comparing this cost of circulation of water to the cost of circulating steam in a steam heating plant, the following example will probably act as a guide in a comparison of this kind:

Five pounds has been taken as the probable initial pipe line pressure or as the back pressure on the engines. Engines operating without a heating plant will exhaust at atmosphere or into a vacuum. Assuming that they operated at atmospheric back pressure, we find in the case of a 16x18 simple engine operated at 50 lbs. mean effective pressure, that increasing the back pressure to 5 lbs. will decrease the output 6% or require 6% more steam to operate the engine at the same load. In this case the cut-off of the engine would be changed or the boiler pressure would be increased to give the same output.

To handle approximately the same amount of heating space as stated in the hot water example, there will be required 60,000 sq. ft. of steam radiation. This radiation will require on an average 0.2 lbs. of steam per square foot of radiation per hour, or 12,000 lbs of steam per hour; 6% of 12,000 is 720 lbs. of steam, which is equal approximately to 26 boiler horsepower.

The above example is a rather rough computation, but explain a method which can be used to compare the cost of circulating the heating medium whether steam or hot water.

IN CONCLUSION.

Whether or not you can improve your station operation depends entirely upon the efforts you put forth in that direction. We are in the heating business to make money out of it. As a rule we are obliged to go to the accounting department for information relative to what we are doing as to the amount of coal we burn; the amount of money spent for labor, supplies, etc.; all of which is absolutely wrong. The operating engineer should know all of this and he should also be able to have the following information at all times:

Coal burned under each boiler.

Water evaporated or heated by each boiler.

Furnace conditions such as draft and gas analysis.

The peculiar part of this proposition is that it is as easy—and sometimes easier—to obtain this information in a small plant as in a large one. Where boilers are stoked by hand it is a very easy matter to weigh the coal fed to each boiler; and a water meter of some sort or other should be installed to measure the water fed to, or circulated through each boiler.

How are you going to tell whether or not you are operating efficiently, if you don't know what you are doing? It is ridiculous to sell a product if you don't know what it costs you to manufacture it, and yet 90% of the heating plants are operated that way. The committee has investigated several plants that have recently started keeping accurate costs and in every case the saving has been sufficient to pay for the instruments and apparatus purchased in from one month to five months—pretty good interest on the investment. In one case there was no special effort made to change conditions as to operation except that the men in the plant knew that their record was being watched. In the first two months the cost per Kw. H. has been reduced and the saving in coal the first sixty days paid for the apparatus and instruments seven times over. Nearly every employe is willing to improve his record if he only knew how and had some way of telling what he is doing. Furnish the way for him to tell.

RESULTS OBTAINED IN ONE INSTANCE.

There is nothing more interesting from an operating point of view than to watch the details and see the improvement that can be made in the operation of a station. In one of the stations investigated by the committee, the following results have been obtained through purchasing approximately $500.00 worth of apparatus; the plant had been paying $4.65 a ton for coal and had been developing one Kw. H. on 4.85 lbs of coal. After purchasing a General Electric flow meter for measuring boiler feed water; a portable CO_2 instrument, and a differential draft gauge, this station was able to burn a cheaper grade of coal with which they developed a Kw. of electricity with 5 lbs. of coal, the cheaper grade of coal cost $3.30 as compared with the coal they were burning at $4.65 per ton. With the higher priced fuel the coal cost per Kw. H. was 1.4 cents; with the less expensive fuel, coal cost per Kw. H. was 0.82 cents. This station turned out approximately 300,000 Kw. H. per month. A saving of $1,740.00 per month was made in the fuel bill in this station. When the less expensive fuel was first fired they had considerable trouble in carrying their load and the differential draft gauge together with the CO_2 instrument showed them that the baffling in the boilers was not correct. When certain changes were made in the baffling—which was done by the regular operating crew—they found they could burn the inexpensive fuel and make the saving above mentioned.

The committee does not wish to recommend any special type of meter to measure boiler feed water; a number of meters are on the market which give more or less satisfactory results provided that they are operated within reasonable limits.

A point of interest which has come under the notice of the committee is the lack of information as to the cost per thousand pounds of steam under various operating conditions in a given plant. There is no set rule for figuring costs, neither is there any standard method of arriving at them. Ordinarily we consider the cost of steam to be the necessary fuel, water, labor and supplies to generate it. Some of these items are of variable quantities which remain more or less constant per thousand pounds of steam, while others are more or less constant per unit of time, and consequently vary with the size of the output of the station or boiler. In a number of cases a station can generate 50% more steam than it does without increasing the labor cost; without increasing the fixed charges and without decreasing—in many cases—the efficiency of the boiler units.

A great deal of thought and study has been given to the electric generating end of the station operating and it is a well-known fact that a Kw. of electricity can be made during the off-peak periods for considerable less money per Kw. than the average cost throughout the 24 hours. This equally is true relative to generating steam, and it is a point which should be considered by the station operator, and the management of the property should

endeavor to get, if possible, a steam heating load which would fill in to a certain extent the low spots on the output curve. This is a point of minor refinement, but can be worked out in a number of cases. Your committee recommends, therefore, that in order to get economical operating results, it is necessary for you to know what each piece of apparatus in the station is doing; what it can do; and what it would do under various conditions; and then line up the operation so as to get the best results from each piece of apparatus.

The Heating Industry in Canada

CANADIAN PLUMBING CONTRACTORS ALSO DO HEATING, VENTILATING AND ELECTRIC WIRING.

By Norman A. Hill.

(Presented at the mid-summer meeting of the American Society of Heating and Ventilating Engineers, Cleveland, O., July 9-11, 1914).

One of the things that struck me as peculiar when I became a resident of this city and entered into private practice (as a consulting engineer, specializing in industrial engineering work), over two years ago, was the fact that the large plumbing contractors in this city, and throughout Canada generally do, not only heating and ventilating, but electric wiring for both light and power, and in many cases automatic sprinkler equipment, and vacuum cleaning installations as well. This strikes a "Yankee" engineer as decidedly odd (all of us former residents of the United States are called "Yankees" whether we come from New England or Texas), and speaking from eight years' experience in the middle Atlantic States, I have found it very unusual for the average plumbing contractor to undertake electric work, and automatic sprinkler equipment, until I moved to Canada.

It would seem in accordance with the best local practice to use one pipe steam heating where low cost of installation is considered, for cheap residence, apartments, stores, and business buildings. For better class work; such as is found in the smaller manufactories, warehouses, office buildings, hotels, clubs, the best local practice seems to be for either vacuum, steam or vapor heating, using low pressure boilers. As a matter of fact high pressure boilers are not much used in Toronto, except where steam at high pressure is absolutely necessary; this for the reason that electric energy from the hydro plants may be obtained by large consumers at or about 1 cent per kilowatt delivered.

HOT WATER HEATING POPULAR.

Hot water heating is very popular for the better class of residences and apartment house work, and strange to say it is still considered good practice locally to use twin connections, that is both supply and return connections being made at the same end of the radiator. By this I mean it is considered good practice by the Canadian heating contractors, although I do not know of any of the local consulting engineers (who are practically all former United States citizens) who approve this twin connection arrangement with the old fashioned twin headers at the boilers, and separate feeders and returns run therefrom to each set of risers. Where work is laid out by one of our consulting engineers it is in accordance with the best American practice, and a tendency, as shown in the open tank system of gravity hot water heating, is to use rather small sizes and high velocity in order to enable the operator to warm a house up quickly in the morning after the system has been allowed to cool over night. In connection with local hot water heating it is interesting to note that forced hot water circulation is rather a new thing here, but fast coming into acceptance.

SEPARATE CONTRACTS CUSTOMARY.

As to local contracting practice, it is much the same here as any place else in eastern Canada, that is to say, there is a decided tendency to let work by sepa-

rate trades, rather than by general contract; as is the practice in the United States, wherever the operation is of considerable size. This custom, of course, makes a great deal more work for the architects or engineers than is necessary where a general contractor is employed, but may be better for the heating industry generally, in that the heating contractors are not at the mercy of unscrupulous builders, who having once closed the contract "shop" the various sub-contracts for their own personal profit, regardless of the best interests of the owner, or the sub-contractors, whose tenders they used in making up their estimates. There is, however, a serious objection to this practice of letting the work on a large building by separate trades, in that the average architect or engineer seems unable to prevent the overlapping of work between contractors, and the omission of certain work due to the division of responsibility.

Now as to time and material work in Canada, it was interesting to me to find that most of it was done on a cost plus 25% basis, and generally speaking it would seem that contractors for heating and ventilating do business in Canada upon a larger margin of profit than is customary in the middle Atlantic States. This has resulted, together with the duties paid on imported materials, in increasing the cost of heating and ventilating work here on an average of from 20% to 30% more per unit than costs in Philadelphia, for example.

COMPULSORY VENTILATION LAWS.

Laws for compulsory ventilation of factories are fairly comprehensive in the Province of Ontario now, and in this city the medical health officer is at present requiring the owners of moving picture theatres and other public places of amusement to provide better ventilation, but there is really no satisfactory standard, or established practice for providing adequate ventilation for public buildings in this city, or elsewhere in the Province of Ontario, and I understand that conditions are similarly unsatisfactory as to ventilating laws, throughout Canada.

The local society of heating and ventilating engineers, which has a membership of over forty, is endeavoring to obtain legislation along the lines of adequate compulsory ventilation for all public buildings and factories of whatever natrue.

Air conditioning as it is generally known, including humidity control, and air purification, has made little progress in Canada, except in the best class of public school work, colleges, and banking houses, but I am glad to say there is a decided movement on foot to make proper air conditioning a requirement by law in all public school houses in the city of Toronto.

Automatic temperature regulation also, has not made nearly the progress it has in the eastern United States; temperature control installations being pretty well confined, so far, in Canada, to the best class of hotels, office buildings, banking houses and private schools.

A PROMISING FIELD FOR HEATING SPECIALTIES.

The greatest opportunity to-day in Canada, in the heating industry, to my mind, is that existing for the manufacturer of heating specialties, that is to say, the concern which is in a position to open up a branch factory in Canada, and manufacture their product and place it upon the market, as a "made in Canada" article, for example: A great many of the steam specialties used in the better class of heating installations here, are imported from the United States, and I believe that a manufacturer with a complete line of heating specialty apparatus, including vacuum, and vapor valves, angle, gate and radiator valves, pressure control and reducing valves, boiler fittings, gauges, temperature regulators, air valves, floor and ceiling plates, and the miscellaneous specialties required for steam, vapor and hot water heating would have an excellent field; particularly, if in connection with the line, he would manufacture good reliable elevators, vacuums and boiler feed pumps.

The field for contracting work, to my mind, is not so good for the United States concern contemplating a branch office in eastern Canada. Nor is there the opportunity now existing, but there was some three or four years ago, for the new consulting heating engineer in this field. However, this huge country (larger in actual area than the United States) has room for all.

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JUST what the effect of the European war is to be on American industries, especially the heating trade, has been a subject of anxious inquiry during the past month. While all reports agree that America must benefit in the long run from the war, it has not been so clear what were the immediate prospects and how long an interval must elapse before American industry could accommodate itself to the changed conditions. Taking the building construction figures as a criterion, it is undoubtedly true that many projected buildings will be held up until the financial atmosphere clears a bit. This refers to buildings whose erection can be postponed without special hardship to the builders. Other classes of buildings, such as schools, hospitals, etc., for which appropriations have already been made, will, for the most part, go forward as planned.

To offset the loss in general building construction, a brand new field will be opened up in the construction and equipment of manufacturing buildings to produce many of the materials that hitherto have been obtainable only from the warring nations and principally from Germany. American manufacturers have awakened with a jolt to a realization of the fact that many of their essential supplies, such as dyes in the woolen trade and certain acids in the chemical trade, are almost entirely imported and that the supply on hand is comparatively insignificant. This situation has already created a demand for the manufacture of such articles in this country and within the present month plans will be filed for the construction and equipment of new plants to engage in this class of manufacturing. How large this movement will be remains to be seen, but it may easily result in an extension of building construction that will more than offset the falling off in other classes of buildings.

The heating trade itself is to be envied in that it is almost wholly a domestic proposition and while it must feel the effect of any widespread derangement of business, it will be one of the first to benefit from the anticipated building boom.

THE gradual passing of the "old guard" of the heating trade, which is marked by the deaths of two of its prominent members during the past month, is of more than sentimental interest, because such men were not simply old-time figures in the trade; they were among the pioneers whose achievements have had a direct bearing on the development of the art. In this respect, owing to the comparative youth of the industry itself, their places will never be filled. The "old guard" of the future no doubt will be men who will leave an equally forceful stamp of their personalities on the trade, but who will have had no share in the pioneer work accomplished by the previous generation.

THE CONSULTING ENGINEER

"The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

35—Effect of Drop in Pressure on Pipe Losses.

QUESTION: Suppose a steam line is designed to carry 800 lbs. of steam per minute at 150 lbs. gauge, with 11 lbs. drop in pressure for a length of 1,000 ft., without non-conducting covering the pipe, there would be a loss from radiation resulting in condensation. Would this loss in radiation tend to decrease the drop in pressure?

If the line were covered with a good insulator, thus saving 80% of the radiation losses, will the drop in pressure be decreased and how much?

Also, assuming the steam were superheated to 150° F., can you tell me what the loss in temperature would be at the end of the line if the pipe were bare, and what the temperature would be if the pipe were covered, saving 80% of the radiation?

ANSWER: The first step requires the determination of the size pipe for the given service in order to calculate the loss by radiation when covered and uncovered. As the conditions surrounding the outside of the pipe are not specified, they will be assumed to be 40° F. and with a transmission from the bare pipe of 3 B.T.U. per hour per degree difference in temperature within and without. If these assumptions are unsatisfactory for the particular problem under consideration, the results may be modified by the substitution of other quantities in the given formulas.

Except for the radiation losses of the main, there is no decrease in the heat content of the steam when flowing through a pipe. Therefore, the smaller the pipe, the less the heat loss in B.T.U., but the greater the drop in pressure. Under all ordinary conditions the loss in pressure due to velocity head is negligible and less than the probable error of the formula for friction and that due to the difference between the assumed conditions and those found in actual practice.

The work due to overcoming the friction head is returned to the steam in heat, raising its quality or degree of superheat. The friction formula used in this discussion is from Konrad Meier's work on "Mechanics of Heating and Ventilation." Marks and Davis's steam tables are used for the properties of steam. The formula used is

$$Pf = \frac{0.0257}{2g} \times \text{spec. weight} \times \frac{V^{1.95}}{D^{1.2}} \times \text{length},$$

in which

Pf = loss in pressure due to friction in pounds per square foot, to be changed in this discussion to pounds per square inch by dividing by 144.

2g = force of gravity (64.4).

D = diameter of pipe in feet, to be changed to diameter in inches by multiplying by 12.

l = length in feet, given in this case as 1,000.

V = velocity of steam in feet per second.

W = weight of steam in pounds per second at the average conditions given as 800 lbs. per minute, or 13.33 lbs. per second.

K = weight of steam at any pressure per cubic foot, in pounds.

$0.7854 \times D^2$ = area of pipe.

and

$V = W \div (K \times 0.7854 D^2)$.

Substituting for V in the first formula, we have

$$Pf = \frac{0.0257}{64.4} \times K \times \frac{\left(\frac{W}{K \times 0.7854 D^2}\right)^{1.95}}{D^{1.2}} \times 1{,}000.$$

Pf is in pounds per square foot and D is in feet.

$$Pf = \frac{25.7}{64.4 \times 144} \times \frac{K}{K^{1.95}} \times \frac{1}{0.7857^{1.95}} \times \left(\frac{W}{D^2}\right)^{1.95} \times \frac{1}{D^{1.2}}.$$

D is in inches. Pf is in pounds per square inch.

$$Pf = \frac{25.7}{64.4 \times 144} \times \frac{12^{5.1}}{0.7854^{1.95}} \times \frac{W^{1.95}}{K^{0.95} \times D^{5.1}}$$

Pf in pounds per square inch = log. 25.7 – log. 64.4 – log. 144 + 5.1 x log. 12 – 1.95 log. 0.7854, or

log of factor is 1.4099331 – 1.8088859 – 2.1583625 + 5.1 x 1.0791812 – 1.95 x – .1049091 = 3.1510816 = log. of 1,416.06.

Pf in pounds per square inch =

$$1{,}416.06\ [(W^{1.95} \div K^{0.95} \times D^{5.1})].$$

By the inspection of this formula the question can be answered directly:

The greater the condensation or radiation of the main, the greater weight of steam per second to give a final desired net quantity at the end of the line. Therefore, if the main were uncovered and the same quantity of steam was desired at the end of the line as if covered, the greater the drop.

As the pressure increases for saturated steam the greater the weight per cubic foot and, as K is the denominator, the less the drop in pressure.

The greater the degree of superheat, the less weight per cubic foot—therefore the greater the drop in pressure, as K is less and in the denominator.

The radiation of the pipe will be greater for superheated steam than for saturated steam at a given pressure, and the total heat content will be greater. Superheat serves no purpose except the prevention of the removal of water from the condensation of saturated steam, as applied to steam mains. It is, however, advantageous to provide superheat for the radiation of mains beyond the requirements at the end of the line.

DETERMINATION OF PIPE SIZES.

The determination of the pipe sizes will be as follows:

800 lbs. of steam per minute is 13.33 lbs. per second, or W.

150 lbs. gauge is 165 lbs. absolute pressure. We will, throughout the discussion, use absolute pressures instead of gauge pressures. Assume a drop of 10.5 lbs. per square inch, instead of 11 lbs., on account of the pressure due to the velocity head. The final pressure will be 154.5 lbs., and the average pressure will be 159.5 lbs. per square inch, or a volume of 0.3518 lbs. per cubic foot, or the value of K.

Substituting in the formula:

log. 10.5 = 3.1510816 + 1.95 log. 13.33 – 0.95 log. 0.3518 – 5.1 log. D.

log. D = [(0.431019 + 2.1936285 + 3.1510816 – 1.0211893)] ÷ 5.1.

log. D = 0.9342235.

D = 8.5945 in. diameter, or a 9-in. pipe.

The loss by radiation on a bare pipe with saturated steam will be, for 159.5 lbs. average and a temperature of 363.5° F.: 9-in. pipe has 0.4 sq. ft. of surface per lineal foot of pipe. [1,000 ft. x (363.5° – 40°) x 3 B.T.U.] ÷ 0.4 = 2,426,250 B.T.U. per hour; and this, divided by 60 = 40,456 B.T.U. per minute.

The latent heat at the final pressure of 154.5 lbs. absolute is 861.2 B.T.U. per pound, and the difference in total heat between 165 lbs. and 154.5 lbs. is 1,195 – 1,193.9 = 1.1 B.T.U. per pound, and the total heat available for radiation losses per pound of condensation is 862.3 B.T.U.

With the 9-in. pipe covered, the pounds of steam condensed, due to radiation, will be, per minute and per second,

40,456 B.T.U. ÷ 862.3 B.T.U. = 47 lbs. per minute and 0.8 lbs. per second.

The drop in a 9-in. pipe will require an average load of 13.33 + 0.4 = 13.73 lbs. per second, or one-half the loss in condensation due to radiation, plus the regular required load. The drop in pressure will be:

log. Pf = log. 1,416.06 + 1.95 log. 13.73 – 0.95 log. 0.3518 – 5.1 log 9.

log. Pf = 3.1510816 + 2.2184575 + 0.431019 – 4.86663675.

log. Pf = 0.93392135 = 8.5886 lbs. drop per square inch.

The percentage of water in the steam at the end of the line will be, if 0.8 lbs. is condensed per second:

0.8 ÷ 13.33 = 6% water, or the quality, if the water is not removed by a separator, 94% at 155 lbs. absolute, or 140 lbs. gauge.

The pressure loss due to the velocity head is found by the formula: $Pv = KV^2 \div 64.4$, in pounds per square foot. K, as before, is the weight per cubic foot in pounds at the average pressure.

Transforming the formula to pounds per square inch in terms of the weight per second of steam delivered:

Cubic feet of steam = W ÷ K.

Velocity = Cubic feet of steam per second ÷ area of pipe.

Area = diameter squared x 0.7854 in square feet.

$V = (W^2 \times 12^4) \div [D^4 \times (0.7854)^2 \times K^2]$. D is in inches.

Pv in pounds per square inch = Pv pounds per square foot divided by 144.

$Pv = [K \times W^2 \times (12)^4] \div [64.4 \times 144 \times (0.7854)^2 \times K^2]$.

$Pv = 3.625\ [W^2 \div (D^4K)]$.

The loss due to velocity head in the 9-in. pipe uncovered will be:

$Pv = 3.625\ [(13.73)^2 \div (9)^4 \times 0.3518] = 0.296$ lbs. per square inch.

The total drop will then be 8.5886 + 0.296 = 8.885 lbs. per square inch.

If the pipe is covered and 80% of the radiation saved, the loss per minute will be 47 lbs. x 0.2 = 9.4 lbs. per minute, or 0.16 lbs. per second. 13.33 + 0.08 lbs. = 13.41 lbs. per second.

Using the last equation:

$Pv = [(13.41)^2 \div (13.73)^2] \times 0.296 = 0.282$ loss due to velocity.

Pf = 0.93392135 – log. 13.73 x 1.95 + log. 13.4 x 1.95.

Pf = 0.93392135 – 2.2184575 + 2.1987862.

Pf = 0.91425 = 8.2082 lbs. + 0.282 = 8.490 lbs. per square inch, or about 0.395 lbs. per square inch less drop in pressure, if covering is used instead of bare pipe.

If superheated steam were used at 150 lbs. gauge pressure and 150° F. superheat, with the same pipe uncovered, the loss will be as follows:

With a drop of 10 lbs., the final condition will be 155 lbs. absolute and about 38° superheat. The average condition will be 160 lbs. absolute and 90° superheat. With an average volume or density of 0.3070 lbs. per cubic foot and a temperature of 454° F., the radiation uncovered will be:

[1,000 x (454 – 40) x 3] ÷ 0.4 = 3,105,000 B.T.U. per hour, or 863 B.T.U. per second.

The load in steam in weight will be the same throughout, or 13.33 lbs. per second, and there will be only a change in its temperature and pressure conditions. The loss will not be divided by 2 as with saturated steam, as in that case the steam was actually condensed to water, reducing the volume.

863 ÷ 13.33 = 64.7 B.T.U. per pound of steam delivered.

The total heat initially at 165 lbs., absolute and 150° superheat is 1,277.6 B.T.U. per pound, and deducting 64.7 B.T.U. will give a final condition at 155 lbs. absolute of total heat 1,212.9 B.T.U., or a superheat of 35°, and an average weight, K, of 0.307.

Pf = log. 1,416.06 + 1.95 log. 13.333 – 0.95 log. 0.307 – 5.1 log. 9.

Log. Pf = 3.1510816 + 2.1936285 + 0.4872185 – 4.86663675.

Log. Pf = 0.9652919 = 9.232 lbs. per square inch.

Pv = 3.625 [(13.333)² ÷ (D⁴ x 0.307)] = 0.319 lbs. per square inch, or a total of 9.55 lbs. per square inch.

It should be remembered that in this case the final steam has a content of 1,213 B.T.U. per pound, while the saturated steam has a content of 1,194 B.T.U. per pound. The heat available for power, above the latent heat at 212°, or 970 B.T.U. + 180 = 1,150. 1,212.3 – 1,150 = 62.3 B.T.U., steam 155° superheated. 1,194 – 1,150 = 44 B.T.U., or the superheated steam has 40% more heat available for power.

If the 9-in. pipe, with superheated steam, were covered, the temperature will be somewhat higher than if uncovered. Using the data of the uncovered pipe for approximate loss, we have, with 80% covering:

64.7 B.T.U. per pound of steam delivered x 0.2 = 12.94, or 13 B.T.U. per pound per second.

The total heat at 155 lbs. and 150° superheat is 1,277.6 – 13 B.T.U. = 1,264.6 B.T.U. per pound at 155 lbs. pressure. The final superheat will be 130°. The average condition will be 1,277.6 – 6.5 = 1,271.1 B.T.U. at 160 lbs. pressure or 140° superheat, or an average temperature on the outside of the pipe of 500° F.

[1,000 x (500 – 40) x 3] ÷ 0.4 = 3,450,000 B.T.U. per hour.

(3,450,000 ÷ 36.00) x 0.2 = 191.6 B. T. U. per second.

191.6 ÷ 13.33 = 14.4 B.T.U. per pound per second.

The actual final condition will be 1,277.6 – 14.4 = 1,263.2 B.T.U. per pound, or 155 lbs. and 125° superheat.

The average condition will be: 1,277.6 – 7.2 = 1,270.4, or at 160 lbs. 137° superheat. The average volume will be 0.2882 lbs. per cubic foot.

Pf = 0.9652919 + log. 0.307 x 0.95 – log. 0.2882 x 0.95.

Pf = 0.9652919 – 0.4872185 + 0.5232907.

Pf = 1.0013641 = 10.003 lbs. steam per square inch.

Pv = 3.625 (W² ÷ D⁴K) = 0.319 lbs. per square inch, pipe uncovered.

Pv = (0.319 x 0.307) ÷ 0.2882 = 0.34 lbs. per square inch, pipe covered.

The drop with the pipe uncovered, with superheated steam, is 9.232 + 0.319 = 9.55 lbs. per square inch. The drop with the pipe covered is 10,003 + 0.34 = 10.343 lbs. per square inch, or a difference in favor of the uncovered pipe of 0.793 lbs. per square inch. The covered pipe, however, is delivering the greater capacity in heat units.

The net heat above 212° and atmosphere, for power purposes, is in one case 1,277.6 – 64.7 – 1,150.4 = 62.5 B.T.U. per pound, with the pipe uncovered.

The net heat in the case of the covered pipe is 1,277.6 – 1,150.4 – 14.4 = 108.8 B. T. U. per pound, or 72.5% greater heat available for power with only 0.08 increase in drop in pressure.

The discussion shows that when transmitting steam long distances, large drops give smaller mains and less loss by radiation, and superheat of a few degrees above that necessary for the final condition of the steam is all that is required for economy. It would be policy to raise the initial pressure so as to give a drop of 16 lbs., and an 8-in. line could be used, reducing the cost of pipe and losses. By raising the drop to about 30 lbs., a 7-in. pipe could be used and the loss by radiation would be directly proportional to the square feet of surface per foot of pipe. A 9-in. pipe has 2.5, an 8-in. pipe 2.34 and a 7-in. pipe 0.2 sq. ft. per lineal foot. The gain in per cent. would be 6.4% for an 8-in. pipe over a 9-in. pipe and 2% for a 7-in. pipe over a 9-in. pipe.

LEGAL DECISIONS

Negligence—Evidence.

A heating company's meter inspector went into a customer's basement to inspect a meter. In the basement was piled certain jute waste. In an action by the customer against the heating company the only matter concerning which the parties were agreed was that on that day the waste took fire. The evidence was in direct conflict as to whether the inspector carried a lighted candle or an electric torch. The inspector denied that he went near the meter, near which the jute was piled. There was evidence that the inspector was there long enough to read the meter, and that fire was discovered two minutes after he came out. It was held that the question whether the inspector negligently set fire to the waste should have been submitted to the jury, notwithstanding that the defendant advanced several theories, each supported by some evidence, that the fire happened from other causes.—Louisville Pillow Co. vs. Kentucky Heating Co., 162 S. W. 1120.

Breach of Contract—Damages.

When the work of improvements on a building were nearly completed a dispute arose as to the amount of the contract price, and the contractor quit work. In an action to enforce a mechanic's lien for the work done the owner claimed damages on account of the plaintiff's refusal to complete the work. The dispute being determined in favor of the contractor, it was held that the owner was not in a position to complain because the contractor refused to proceed further with the contract.—Draper vs. Miller, Kansas Supreme Court, 140 Pac. 890.

Evidence of Damages Caused by Breach of Warranty.

In an action on a note given in part payment of a heating apparatus the defendant counterclaimed for damages for breach of the plaintiff's guaranty. In 1907, in pursuance of a written contract, a heating apparatus was installed by the plaintiff in the defendant's residence at Mt. Holly, by which the plaintiff guaranteed that the apparatus would perform certain work in the heating of the house. It appeared by the evidence that it was not provided with the radiator surface called for by the contract; that it did not do the work that it was guaranteed to perform; and that as constructed it did not have the capacity to do that work. It also appeared that in spite of its defects the defendants had kept the apparatus and had used it for four years without having altered it in any respect.

In order to show the damage caused by the breach of guaranty, counsel for the defense asked the following questions of an expert witness: (a) "By the difference in the radiation from your examination and what the contract called for, how much would the contractor save?" (b) "What would be the difference in the cost?" (c) "What would it cost for the difference in placing and replacing this radiation?" (d) "What would it cost to put that heating apparatus in proper shape by the introduction of larger pipe for the purpose of carrying the radiation?" Objections by the plaintiff to all these questions were sustained, and the trial judge directed a verdict for the plaintiff for the amount of the note with interest, on the ground that the defendants had failed to show the damages arising through the breach of warranty. On a motion for a new trial it was held that the general rule is that where the buyer retains the article sold, the measure of the damages recoverable for a breach of warranty of quality is the difference between the actual value of the article at the time of the sale, and what its value would have been if it had been as warranted. In Pennsylvania this rule has been applied to machinery. The evidence in the present case failed to show the impossibility of establishing, as of the fall of the year 1907, either the actual value of the heating apparatus that the plaintiff delivered or its value had it been as warranted; nor was there anything to indicate that the difference between these values would not fairly represent the real loss that the defendants sustained by reason of the breach of the warranty. The court was of the opinion that the damages for the breach of the warranty of a heating apparatus should be measured by the rule applied to the case of a gas engine, a steam engine, or an electric generator. The defendants, therefore, should have proved the value of the apparatus received and its value if it had complied with the warranty. If would not have helped toward this if the witness had been permitted to answer question (a), because the savings of the contractor who scamps his job do not necessarily represent the difference between the value of what he has agreed to furnish and the value of what he actually supplies. Moreover, this question did not relate to the date when the heater was installed, but to the time of the trial or a later day. For the same reasons question (b) was objectionable. Taken literally, question (c) was unintelligible. Question (d) also related to the wrong point of time, and was

not pertinent to the rule governing the measure of the defendants' damages. There being no evidence to support the counter claim a new trial was refused, and this was affirmed on appeal.—McClintock vs. Mattack, 52 Pennsylvania Superior Court, 266.

Mechanical Engineers Postpone Action on Name for Standard Flange Schedule.

According to action taken at the recent spring meeting of the American Society of Mechanical Engineers in St. Paul-Minneapolis, June 16-19, 1914, the matter of naming the proposed new standard schedule for flanged fittings and flanges will be referred to a committee composed of appointees of each of the societies or bodies interested in the schedule.

It will be recalled that the society had tentatively called the schedule the "American" standard. This was vigorously opposed by representatives of the National Association of Master Steam and Hot Water Fitters, the point being made that as the first report was issued under the name of the "1912 U. S. Standard," and had become widely known, it would be an advantage to retain the name, with the date changed. It was also urged that as the master steam fitters' organization had initiated the movement for standardization the continuation of the original name would be in he nature of a courtesy to that body.

It was said, on the other hand, that orders were being placed for "U. S. Standard" flanges as a result of the 1912 report, without distinction being made as to the year and that confusion might arise if the revised report should bear a similar title.

Those at the meeting in the interests of the National Association of Master Steam and Hot Water Fitters were the late Edward B. Denny, who died shortly after his return from St. Paul, and Earnest T. Child, of New York.

Mr. Denny made a carefully prepared address at the meeting, reviewing the previous efforts of the master fitters' association in developing a uniform standard, dating from the inception of the movement in 1905.

In tracing the subsequent developments Mr. Denny, as reported in the master steam fitters' *Official Bulletin*, continued:

"You are doubtless familiar with the subsequent history—how through the efforts of some of the manufacturers your committee was induced to reopen the matter and to recommend, at your December, 1913, meeting, a schedule quite different from that unanimously adopted less than two years before; how, through the non-concurrent effort of our association action was deferred by your society until this meeting; how the National Association of Master Steam and Hot Water Fitters called a conference meeting at Washington, D. C., on March 7th, of all societies interested in the subject, at which conference all points of difference between 'The 1912 U. S. Standard' schedule and the schedule reported by your committee were fully considered and a compromise schedule agreed upon; how the conference delegated to the committee on standardization of your society, our association, and the manufacturers, the duty of adjusting all differences that had developed and getting out the new schedule in accordance with the decision of the conference.

"One of the things not decided upon by the conference at Washington was the name by which the new schedule should be designated. On March 20 the committee met, as directed, and settled on all points that were not definitely settled by the conference at Washington, including the name which it was unanimously decided should be 'The 1915 U. S. Standard' schedule. I am told that the minutes of the meeting of committees, held March 20, as sent out by the chairman of your committee, refer to the vote on the name as being an informal vote and that the members of said committee have been invited to vote again on the subject by mail. According to the testimony of all members of our committee, the secretary of the manufacturers' committee, and at least one member of your own committee, the vote by which the name, 'The 1915 U. S. Standard' schedule, was adopted was not an informal vote, but was a vote regularly made and seconded and adopted without dissent. I am free to say to you that had there been any attempt at that time to adopt any name other than 'The U. S. Standard' schedule the members of our committee would have strenuously opposed it and a vote taken in such a meeting, after discussion, might be very different from one taken by mail without discussion. Mr. Child, a member of our Committee on Standardization, has with him original data bearing on all phases of this matter, and will be pleased to go into all details if you conclude that your decision should rest upon technical evidence.

"Possibly you are wondering why, since the main object of all of our efforts has been secured by the final adoption of a uniform schedule by all parties interested, including the manufacturers, we thought it necessary to come here and try to persuade your society to refuse to sanction any other name for the schedule than that originally adopted. There are several reasons that seem to us sufficient and which I believe will appeal to the honorable members of your society.

"After the adoption of 'The 1912 U. S. Standard' schedule, our association was very

active in securing its use by many heating engineers, United States Government officials, State engineering officials, and master steam fitters throughout the country. While in such efforts we never failed to state that the schedule was the work of the joint committees of the American Society of Mechanical Engineers, and the National Association of Master Steam and Hot Water Fitters, our association became, in a measure, identified with the schedule, and we got such credit for our work as we were fairly entitled to. It is our belief with the continuance of the name 'The U. S. Standard' schedule, we will continue to receive our fair share of the credit to which our large expenditure of labor and money fairly entitle us. On the other hand we believe that the adoption of the name 'American Standard,' will result in practically all of the credit being given to your society. In view of the whole history of the effort and its results, this would be manifestly unfair. We cannot believe that your society, as a whole, will vote to inflict such an injustice upon the National Association of Master Steam and Hot Water Fitters.

"2. If the name 'U. S. Standard' were not appropriate or if the name 'American' were more appropriate for the schedule, we might pocket our disappointment and consent to the more appropriate name, but it seems to us that 'The U. S. Standard' is far better than 'American' from every viewpoint, except that of reflecting exclusive credit upon your society. Any standard adopted by us can apply only to the United States. It would be unwarranted presumption for us to fix a standard for Canada or any South American country, as would be implied by the name 'American Standard.' We have no moral right to do so.

"3. 'The 1912 U. S. Standard' schedule has been adopted and is in use by various departments of the United States Government in their specifications for flanged fittings and flanges. The officials in these departments have been much pleased with the name 'U. S. Standard" schedule, and while they would not mind the change of date, from 1912 to 1915, they would not be pleased with the change from U. S. to American. We had much help from the United States Government officials in making and maintaining the original schedules and in arriving at acceptable compromises in the Washington conference. All of which should influence us to retain the original name.

"4. Assuming that the matter had been finally settled by the vote of the committees on March 20, our association immediately advised many concerns that were waiting for the definite decision, and in all such notices we gave the name of 'The 1915 U. S. Standard' to the new schedule. We also issued under that name printed schedules of flanges as agreed upon. At the annual convention of our association we adopted the report of our Committee on Standardization with its recommendations, in which the new schedule was called 'The 1915 U. S. Standard.' This is today our name for the new schdule—it will undoubtedly be so distinguished in United States Government specifications. If your society votes to call it by another name, there will continue to be confusion in the names while the schedules themselves will be identical."

Notes on the Separate Contract Situation.

FROM A DISCUSSION BEFORE THE HEATING ENINEERS' SOCIETY.

D. D. KIMBALL: I am glad to note that in Canada the tendency is to let building construction work by separate contracts. To my mind there is no justification for any other method. I believe that in three States in the East there are now laws requiring separate contracts on all State and, in some cases, on county and city work. I hope that such legislation will spread to the remaining States of the Union. I cannot see for the life of me where it makes more work for the architect and engineer. I am doing several jobs which were let as general contracts. From the standpoint of the engineer it imposes a lamentable amount of unnecessary work. In certain cases matters of difference have to be carried back and forth between the general contractor, sub-contractor, the archiect, etc., and by the time the whole matter has been passed backward and forward it sometimes takes days, weeks or months before the final round up is made, and in some cases it is never completed. If the engineer is paid on a commission basis he is lucky if he gets paid in any reasonable time.

THEODORE WEINSHANK: I know of a case in a certain city where a general contractor used to get figures from sub-contractors, and, after receiving the contract, he used to what contractors call "peddle" the sub-contractor's figures. In other words, he would go to one sub-contractor and ask him to cut a certain amount from his original bid, and then go to another contractor and state that "A" has cut his figure and "if you will cut another hundred" he would give him the contract. Keeping this up, he would finally get someone to figure low with him, with the idea of putting in the cheapest material possible.

This certain contractor kept this up until such a time when the contractors "got together" and quoted him on a prospective contract, very low figures, and, after he received the contract, they all withdrew their quotation, thus leaving him with about a $35,000 loss on the contract.

This contractor is out of business today—and for all time to come.

MR. KIMBALL: I do not want my remarks to carry beyond their intent. Some may say if you are going to take separate bids for the plumbing, the lighting and the heating, why not take them on the brick work, carpentry work, etc.? I think that would be going too far. The heating, lighting and plumbing are essentially separate things and can well be divorced without interfering with the work on the building; in other words, they do not affect the building as a structure, but comprise the mechanical equipment. So far as heating, lighting and plumbing are concerned, it seems to me that is growing to be the practice in this country. The material men in the heating, ventilating and plumbing trades, etc., may rise to object that the heating contractors treat them just as the general contractor treats the heating, plumbing and electrical contractors. This is unfortunately true, but this unjust practice can be eliminated by requiring that the heating, plumbing and electrical contractors name in their proposals the particular make of apparatus in each case which they propose to furnish, making this apparatus when approved a part of the contract.

NORMAN A. HILL: As I understand it, the last speaker agrees with my statement that the contracts for a building when let by separate trades, put more work on the architect and engineer. Now, I have been in the contracting end over six years and for over four years have been on the other side of the fence, that is to say, in consulting work, and as our company now handles the architecture as well as the engineering of buildings, I feel that I know whereof I speak. We have found on large work that it is more economical (from possibly a selfish viewpoint) for the engineer and architect to let the strictly structural or construction portion of the building, as far as possible to the fewest sub-contractors, providing that you get men of known standing, and then we sometimes let one firm in Toronto do the electrical, sprinkler, heating and plumbing work, all under one contract, because we know they will do it well, perhaps better than several small firms by separate trades.

As a matter of fact, in Canada, the work of the architect and engineer is less where the number of sub-contractors is small, provided the general contractor is a responsible concern. I think we must agree there is something saved in not having to handle 12 or 15 different sub-contracts.

The Status of Air Ozonation.

An interesting addition to the discussion of air ozonation was made by Prof. J. D. Hoffman of the University of Nebraska, in discussing a paper on this subject, presented by M. W. Franklin at the recent meeting of the heating engineers' society.

Professor Hoffman based his remarks on the following four statements made in the paper:

"According to the modern theory of ventilation the only baneful factors in 'vitiated' air are heat, moisture and odors.

"It has been shown that in the worst cases the available oxygen is far in excess of the demand and that CO_2 is harmless in concentration likely to be met. The conviction once prevalent that organic 'crowd poisons' were the guilty factors likewise has been abolished.

"The most recently demolished belief was that bacteria existed as a menace in re-breathed air.

"The modern practice of ventilation, then, clearly is concerned only with absorbing the almost invariable quantity of heat produced per capita of room occupants, of removing the moisture transpired and of destroying the odors generated, etc.

"According to these quotations," said Professor Hoffman, "there is no question of doubt concerning the wholesomeness of respired air if it is only kept at the proper temperature and humidity and kept free from odors. Let us imagine two men, of equal normal health qualifications, except that one has lost the sense of smell. These men are subjected to an atmosphere heavily charged with offensive odors. Will the man who has the normal sense of smell receive the greater injury? Certainly odors are not harmful. They merely indicate the trouble. I am personally inclined to regard the sense of smell as an easily applied proof of the stagnation of the air, comparable in a way, with our CO_2 test, which is a proof of the amount of fresh air supplied and the distribution of the air in the room. Eliminating odors as being merely unpleasant and not harmful, how about temperature and humidity? Surely heat and water are not baneful factors or harmful to the human body, except as taken in extraordinary amounts.

"Again, no person contends that an otherwise pure atmosphere having less than normal oxygen, or more than normal CO_2 will be fatal, or immediately harmful, although its subtle influence upon health, by long continued applications to these conditions, is still to be proven. Again, the term 'crowd poisons'—what are they? And if we do define them do we know enough about them to be sure there are no such poisons?

"Again, is it conclusively proven that bacteria does not exist in respired air? The careful observer will insist that judgment upon these most vital points should be exceedingly deliberate. I wish to add my work of appreciation for the work done by the experimenters quoted. I have read of these experiments and have admired the pains-taking carefulness employed. I am a believer in the

sincerity of all the persons employed in the work, and accept the results as genuine, but cannot accept the conclusions of some of them.

"To subject persons in normal health to bad air conditions for a few hours or days, and then draw conclusions as to the permanent health effects, is not good logic. Because persons may stand certain unsatisfactory surroundings for a brief period without apparent harm does not argue that the same persons could continue this indefinitely.

"Concerning bacterial and germ poisoning, there are many convincing object lessons to be seen all about us. In a family of my acquaintance, one member contracted tuberculosis in an unhealthy trade, and lay for some time before being taken. At this time, all the other members of the family seemed in normal health. But within a couple of years two more were taken in the same way although the disease was contracted differently from the first case. The remnant of the family was advised to move to other quarters and so far as I have learned, no more were taken. The sentiment was expressed that leaving the old home, which no doubt was thoroughly filled with the germs of the disease, saved their lives.

"Another case which exhibited conditions fully as striking was called to my attention. In a fraternity house one of the boys contracted tuberculosis, and while sitting by himself, used one of the discarded heat stacks as a spittoon. After his death one after another of these splendid fellows gave up their lives until the fraternity was completely demoralized. After the cause of the scourge was learned and a move was made to other quarters, everything was satisfactory. If time would permit, hundreds of such cases could be cited.

"Of all the delicate machinery enclosed in the human body no part has more effect upon the general health than the incinerator or purifying plant, we call the lungs. When these are not supplied with air of proper quality or amount, or when they are thrown out of service by disease, stagnation ensues.

"I am convinced that the author of this paper does not wish us to understand that the wholesale destruction of former precedents and ideals in ventilation, as here specified by him, is unconditionally recommended. Notice the first quotation. The word 'baneful' means having poisonous qualities, the state of being harmful or destructive, etc. Also, notice: 'So far as is definitely known the value of ozone in ventilation is not due to any beneficial effect upon the human economy, but to the circumstance that it destroys much that may be objectionable or harmful in foul air, etc.' The whole value of this paper is based upon the fact that ozone has the power to destroy bacteria and harmful substances floating in the air, and, since the author recognizes ozone to be a powerful germicide, he recommends it as an accessory to the modern ventilating system.

"I have no criticism to offer upon this view of the subject except to say that the person not accustomed to inhaling ozone, had better begin with very small amounts and increase the dose gradually. In experimenting with an ozonator, in my office, I found it necessary to limit its use, because of the influence of the ozone upon the membrane of the nose and throat of those persons regularly employed in the office. In the lecture rooms, however, where there were large room volumes and many people, the room air was freshened and deodorized and no complaints were made by any persons subjected to its influence for one hour. This paper, therefore, as an exponent for the use of ozone in the art of air conditioning, deserves commendation, but it weakens its position in making final and sweeping conclusions concerning those phases of air conditions upon which there is, as yet, so much uncertainty.

"My conclusion is merely this: when air conditions within room interiors are become the same as those of the pure outside air, you may expect the best physical health of the people."

Condition of Public Building Construction.

On account of the many requests received at the office of the Supervising Architect of the Treasury Department at Washington for the immediate preparation of plans, etc., for particular Federal buildings which have been authorized by existing legislation, irrespective of the date of such authorization, the Supervising Architect has issued the following statement, under date of July 1, 1914, for the information of all concerned:

"Beginning with 1902 it has been the policy of Congress to authorize public building by what are known as 'Omnibus' acts, each act including a great many separate projects. In addition, special acts are passed from time to time, providing for individual projects, increases in the limits of cost of projects previously authorized, etc. The 'Omnibus' Act of 1902 was followed by similar acts in 1903, 1906, 1908, 1910, and 1913.

"It is the present policy to place under contract for construction all buildings, or extensions to buildings, authorized in any one 'Omnibus' act before beginning plans for projects authorized by a subsequent act. It is also the present practice to prepare the plans for all buildings, or projects, authorized in any given act in the order of the dates upon which the titles to the sites herefor were vested in the United States.

"To determine the precise order in which the plans for the various buildings shall receive attention the following procedure is followed: The buildings authorized in any one act are first divided into groups according to the priority of the acts in which their sites were authorized. All buildings in each such act-group are further arranged in the order of the dates of the acquisition of their sites, the earliest date first. For instance, the 1913 act authorizes buildings upon sites which had been authorized in the act of 1908, in the act of 1910, and in the act of 1913. It is intended that the buildings so authorized in 1913 to be erected upon sites authorized in 1908 shall first be placed under contract. These will be followed by buildings authorized in 1913 to be constructed upon sites authorized in 1910. Then the buildings authorized in 1913 to be built upon sites also authorized in 1913 will take their respective turns for attention.

"Extensions are usually authorized to be erected upon land already owned by the United States. While extension projects are included with the buildings authorized in a particular act, discretion is exercised in determining the order in which extensions shall be placed under contract for construction, depending upon the urgency of the need for the improvement.

"The output of plans by the Supervising Architect's Office is governed by the extent of the technical force (designers, draftsmen, computers, superintendents, etc.) which the appropriations given by Congress permit the department to employ.

"At this date the Office of the Supervising Architect has on its books, waiting to be placed under contract, approximately $38,500,000 worth of authorizations for new buildings and extensions, exclusive of the value of the land. This includes the new buildings and extensions in the act of 1913. This office is placing buildings and extensions under contract at the rate of about seven million dollars annually, so that at the present rate of progress the last of the buildings authorized in the act of 1913 will not have been placed under contract until about the beginning of the calendar year 1920. It will not be until after the latter date that it will be possible for the Supervising Architect to place under contract any buildings contained in any act, or acts, which may be passed in the meantime.

"The current program, made up of the remaining projects which were authorized prior to the 1913 act, includes about one year's work from this date. Work upon the plans for buildings authorized in the act of 1913 will therefore not commence until about July 1, 1915. The 1913 act contains the following authorizations:

New Buildings	304
Extensions to existing buildings	23
Total projects	327

"The program of work contained in the act of 1913 has not been laid out as yet. Therefore it is impossible to state even approximately the time when any building authorized in that act will be either advertised for bids or placed under contract.

"If a subsequent act increases the limit of cost, or otherwise modifies prior legislation for a building or extension, before that project is reached in turn, the position of the project in the program of work is not affected thereby. If a project is set aside when its turn is reached in order to await action upon a proposed increase in the limit of cost, or for any other reason, it is taken up, whenever 'released,' in as near its original position as the condition of the work, generally, may render possible.

"No consideration can be given to suggestions that any one project is entitled to any more consideration than another, and requests that buildings be advanced out of their order must be uniformly declined.

"For the information of those not familiar with legislative terminology, it may be stated that an 'authorization' is, as it implies, merely authority to acquire a site, erect a building, etc., within the limit of cost stated, and is not an actual 'appropriation' of money out of the Treasury. Appropriations are made by Congress on the basis of estimates submitted by the Secretary of the Treasury. These appropriations are carried in one or the other of the annual supply acts and are intended to be only sufficient to carry forward the building program for the fiscal year to which the acts apply. 'Appropriations' are made on account of the limits of cost fixed by the 'authorizations' and are not extensions of these limits. All appropriations for sites, buildings, extensions, etc., are available until expended, unless repealed by act of Congress, and are not automatically returned to the Treasury if not expended before the expiration of the fiscal year.

"The Public Buildings Act of 1913 authorized the Treasury Department to acquire sites, erect buildings, construct extensions, etc., aggregating a total cost of nearly $42,000,000, but did not actually appropriate one cent toward the consummation of any of these projects."

War Interferes with Dusseldorf Exhibition.

One of the German projects which the present European war may seriously interfere with is the proposed Dusseldorf exhibition which was to have been held in Dusseldorf, from May to November, 1915. The exhibi-

tion was intended to commemorate "a hundred years of culture and art" and had the backing of a guaranteed fund of 5,000,000 marks. The exhibition, which was to have a section devoted to industry and trade, was being designed to cover over 150 acres of ground. Foreign countries had been invited to participate in the exhibition.

Questions on Heating and Ventilating Engineering.

The following questions are those submitted to candidates in the subjects of heating and ventilation at this year's examination of the City and Guilds of London Institute, which were reproduced in *The Plumber and Journal of Heating*. The examination papers include those for Grade I, Grade II and the final examination (written paper) with the maximum number of marks obtainable following each question:

In each case three hours were allowed for the solutions, and it was stipulated that not more than six questions were to be attempted.

GRADE I.

1. Explain briefly and clearly the following terms: Sensible heat of steam, latent heat of steam, total heat of steam, specific heat of steam, and superheat of steam. How does the specific heat of superheated steam differ from that of saturated steam? (50 marks.)

2. Make clear sketches of the following steam pipe fittings: A 1-in. quarter bend with nipple and lock-nuts, a 2-in. long-radius tee, a 2-in. union, and a 4-in. flanged expansion joint. (50.)

3. What is a "tempering coil," as used in plenum ventilation? Where should it be placed? What useful purpose does it serve, and what evils result from its absence in frosty weather? (40.)

4. Sketch and describe an injector, as applied to feeding a steam heating boiler, and show how it should be connected up. (50.)

5. Draw a cast iron sectional boiler of six sections for low-pressure hot-water heating with 3-in. flow and return, connected to a brick chimney by a 7-in. cast iron smoke pipe with elbow and cleaning door. Why are boilers made in sections instead of in one piece? (50.)

6. (*a*) State the relation between the weight of a given volume of air at normal pressure and its temperature. (*b*) Calculate the volume of 200,000 cu. ft. of air, measured at 40° F., when raised to 70° F. (*c*) Calculate the weight of half a million cubic feet of air at 80° F., given that a cubic foot of air at 0° F. weighs 0.0863 lb. (40.)

7. Describe, with the aid of sketches, how to make a round pipe 12 in. diameter and 2 ft. long, from a flat sheet of tin-plate. The joint must be tight. What tools are required? (50.)

8. Sketch and describe a 2-in. dead-weight safety valve for a small steam boiler, and a 1-in. brass emptying cock. (40.)

9. Sketch, in section, a steam-trap of the float type, and explain its action. (50.)

10. Show, in section, an outlet cowl on the top of a church fitted with a non-return valve to prevent down draught. (40.)

GRADE II.

1. Define the terms, neutral zone and circulating pressure. Show by a diagram the pressures in a warm room provided with openings at floor and ceiling, when natural ventilation is proceeding. (40 marks.)

2. Sketch and describe a pair of rolls as used for bending sheet metals; also a rotary shearing machine. What are the advantages of the latter over straight-bladed shears? (40.)

3. Give the arguments for and against heating a small villa by a gas-fire in each room, in comparison with a hot-water radiator in each room, connected up to a gas-fired boiler or circulator. It is assumed that ordinary coal grates are already fitted in the rooms. (40.)

4. Sketch and describe a gas-steam radiator. What are its advantages and drawbacks when used for heating the hall of a small house? (40.)

5. Make neat sketches of a steam boiler of the Cornish type, in longitudinal section and front elevation. Show and specify all necessary fittings. (50.)

6. What is the relation between a watt and a horse-power? Define the efficiency of an electric motor. A motor of 10 B.H.P. and 70% efficiency is required to drive a fan. Calculate (*a*) the number of watts absorbed, (*b*) the cost per 10 hours of the electrical energy, which is sold at 1d. per Board of Trade unit of 1,000 watts per hour. (40.)

7. The formula for calculating the inflow of air through a given opening (A square feet) into a room of given height (H feet) is

$$Q = 0.61\ A \sqrt{gH \frac{D_o - D_i}{D_i}}$$

Explain fully what this means.

A room measures 25 ft. by 25 ft. by 14 ft. The temperature inside is 60° F. and outside is 32° F. The density of the air outside is 0.0807 lb. and inside is 0.0764 lb. per cubic foot. The area of the bottom inlet and of the top outlet is 2 sq. ft. in each case. Calculate the velocity of flow at inlet and the quantity of air passing per hour. How many times per hour will the air of the room be changed due to gravity alone? (40.)

8. In the case of any building ventilated on the plenum system, with which you are familiar, state any complaints or defects which have come under your notice, and make suggestions for remedying them. (50.)

9. What type of pump would you adopt for a forced circulation of hot water in a large

college building? How does the delivery vary in relation to the speed, when forcing against a constant head, in the case of (*a*) a reciprocating pump and (*b*) a centrifugal pump?

A centrifugal pump is designed to deliver 500 gallons of water per minute against a head of 100 ft. at a speed of 1,700 revolutions per minute. What will be the approximate delivery at 1,500 revolutions per minute against the same head? (50.)

10. Distinguish between momentum and energy. Explain fully the meaning of the following formula, referring to the energy of a moving body (solid or fluid):

$$E = \frac{Wv^2}{2g}$$

Calculate the energy in foot-pounds of 2,000 cu. ft. of air at 60° F. (weighing 74 lbs. per 1,000 cu. ft.) when moving at the rate of 12 ft. per second. (30.)

11. Fig. A (next column) shows to a scale of $\frac{1}{16}$ in. to a foot the one-story drawing office of an engineering works. It is lighted partly by side windows and partly by skylights (north light). The average height is 18 ft. The length is 107 ft. inside (made up of four bays), and the width varies from 45 ft. to 15 ft. The walls are 14 in. thick. The roof slates are laid on boards.

The glass surface in the walls may be taken as 600 sq. ft., and in the roof as 400 sq. ft. The air is changed three times per hour. If a temperature of 65° F. is to be maintained inside the office when the temperature outside is 25° F., estimate:

(*a*) Loss of heat per hour through brick walls, where not shaded in sketch (coeff. 0.3).
(*b*) Loss of heat per hour through total glass surface (coeff. 1.03).
(*c*) Loss of heat per hour through roof surface of 4,400 sq. ft. (coeff. 0.2).
(*d*) Loss of heat for ventilation.
(*e*) Heating surface and grate area of a suitable hot-water sectional boiler, for coal firing.
(*f*) Size of flow and return pipes.
(*g*) Weight of coal burnt per hour, if 1 lb. gives out 12,000 B.T.U. on combustion, and efficiency of boiler is 60%.
(*h*) Total heating surface of pipes and radiators at 140° F. required inside the office, assuming that each square foot will transmit 1.5 B.T.U. per hour for each degree of temperature difference.

FINAL EXAMINATION.

(Written Paper.)

1. Specify the equipment of a workshop, suitable for sheet-metal working, in which 50 men are employed in making cowls, ventilating ducts, and fan casings. (50 marks.)

2. Sketch and describe the action of a contact-thermometer and an electrically controlled regulating valve, as applied to a low-pressure steam radiator, for the automatic control of temperature in a room. What are the advantages claimed for this appliance? (50.)

3. Sketch a curve of circulating pressure in a vertical ventilating flue surmounted by a chimney pot. Explain clearly what this curve means. (40.)

4. Show, by means of a diagram, the proper position of the resultant neutral zone in the case of a kitchen adjoining a restaurant, in order to avoid any smell of cooking in the latter. (40.)

FIG. A—PLAN OF OFFICE FLOOR USED IN EXAMINATION.

5. Explain in detail the procedure in designing systematically a hot-water heating installation for a church, and in calculating the sizes of the pipes. (50.)

6. Summarize the procedure in designing systematically a heating and ventilating scheme, on the plenum system, for a large technical college. (50.)

7. What special considerations should guide one in fixing the sizes of pipes in a system of forced circulation, employing a centrifugal pump? Explain how accelerated circulation may be obtained in a hot-water heating installation without the use of a pump. (60.)

8. Sketch and describe an automatic drain receiver and pump, and show how they are connected up in the case of a combined power and steam heating plant for a large office building. (50.)

9. Sketch and describe the construction and action of a humidifier, as used in cotton mills. How is the humidity of the air measured? (50.)

10. Describe, with the aid of sketches, a dust-removal plant for a grinding shop in which 40 men are employed in trimming small iron castings on emery wheels. What precautions are necessary in the design of the fans and the ducts? Explain the action of a cyclone dust collector. (60.)

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

AIR CONDITIONING—

Improving Air Conditions. E. E. Garlits. Deals with exhaust or ventilating fans, agitator fans, and ozonizers. Ills. 2,500 w. Elec Jour—June, 1914. 20c.

COOLING—

Church Cooling. Description of the air-cooling plant in the Lutcher Memorial church at Orange, Tex. Ills. 1,200 w. Ice & Refrig—June, 1914. 40c.

DEPARTMENT STORES—

Special Requirements in the Heating and Ventilation of Department Stores. Charles L. Hubbard. Brief description of methods of air supply and systems of heating. 1,500 w. Am Archt—June 24, 1914. 40c.

GAS HEATING—

Heating Houses and Buildings by Gas. Tests of the Rector system designed to use artificial or natural gas. Ills. 3,000 w. Gas Age—June 1, 1914. 20c.

The Modern Gas Fire and Hygienic Efficiency. Gives results of recent experiments and conclusions. 3,000 w. Archt, Lond—May 15, 1914. 40c.

VENTILATION—

Suggestions for the Ventilation of Hotels and Clubhouses. Charles L. Hubbard. Drawings and directions for rooms requiring special treatment. 1,500 w. Am Archt—June 10, 1914. 40c.

Ventilation of Hydro-Electric Power Stations. R. C. Muir. Treats of the provisions that must be made by the designer of the power station to meet the requirements. Ills. 2,000 w. Gen Elec Rev—June, 1914. 40c.

Ventilation by Means of Small Motor-Driven Fans and Blowers. Bernard Lester. Small ventilating units and their applications. Ills. 1,500 w. Elec Jour—June, 1914. 20c.

NEW DEVICES

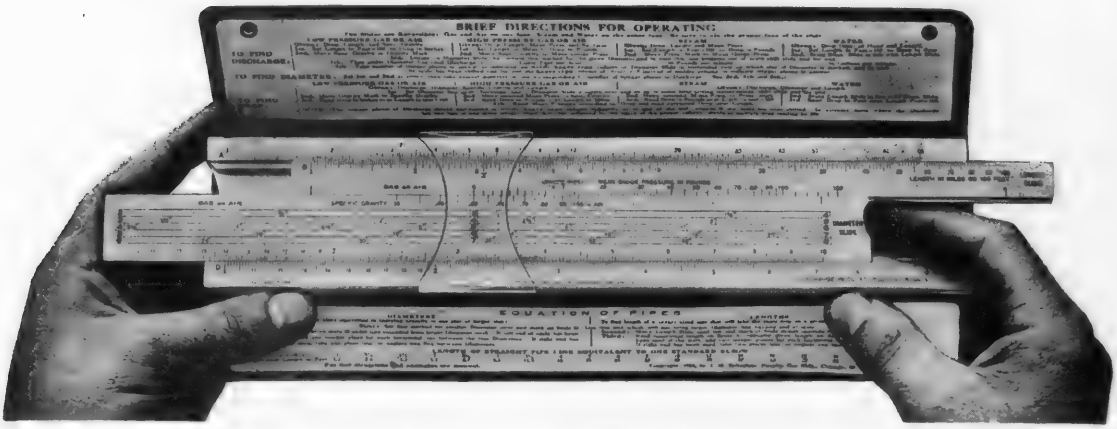
Evans' Automatic Sprinkler Apparatus.

A new design of the Evans' automatic sprinkler apparatus, including sprinkler head, dry valve and alarm valve, has lately been placed on the market by Merchant & Evans Co., Philadelphia, Pa. In a circular announcing the new line the company states that heretofore virtually all "approved" automatic sprinkler apparatus has been installed directly by a small group of manufacturers or by their

small and immediate entourage of contractors, whereas the company's offer is to sell direct for the users' own installation, or to install direct from its plant on percentage or flat contracts, or to serve the public through its licensees, a list of which is given, who are prepared to contract independently in their respective areas.

Spitzglass Slide Rule and Flow Computer.

A new device for calculating the flow in pipes of air, gas, steam and water, the design of which is based on the new and extensive tests presented before the Illinois Gas Association, has been designed by J. M. Spitzglass, Chicago, Ill. The instrument is also used for all ordinary slide rule calculations. No adjustments are necessary to allow for atmospheric conditions, the instrument being made of solid celluloid. As indicated in the tests referred to, some of the existing data on the flow of fluids is incorrect, it having been shown, for instance, that in a 1½-in.



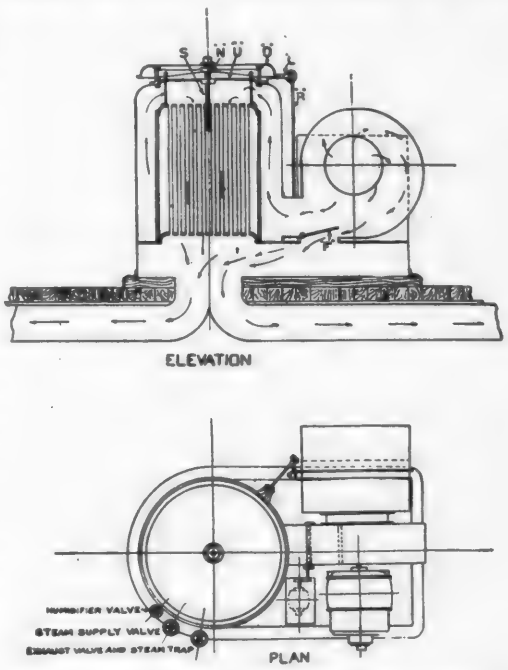
THE SPITZGLASS SLIDE RULE AND FLOW COMPUTER.

pipe Pole's formula gives the flow 28% high and Unwin's 7% high, while for a 12-in. pipe Pole's formula was found to be 9% low and Unwin's formula 2% high. The Spitzglass device is 11 in. long and 2½ in. wide. It is furnished, together with manual, for $10.00, postpaid. The sales are handled by the Slide Rule Co., 454 People's Gas Building, Chicago, Ill.

Trade Literature.

S. & K. THERMOFANS, designed especially for the heating, cooling and ventilating of ships, are described in a new catalogue issued by Schutte & Koerting Co., Philadelphia, Pa. Some of the various arrangements of these thermofans on different types of ships are illustrated in detail, while the numerous detail views are accompanied by text giving particulars of the apparatus itself and its installation, showing, among other things, how they may be arranged either for cooling by direct contact with water or by the indirect method where excessive humidity is objectionable. One of the advantages mentioned for the apparatus is that it requires no special foundations or housings and may be placed on any floor or deck in any part of the structure. One machine may be used to take care of the whole structure, or the structure may be divided up, separate units supplying each section. A diagram is included of comparative tests showing the advantage of indirect heating and ventilating on the thermofan system compared with direct steam pipe or radiator heating with ventilation. Size 8 x 11 in. Pp. 16 (punched for binding).

ROTARY AIR COMPRESSORS, made by the Wernicke Hatcher Pump Co., Grand Rapids, Mich., according to a recent circular announcement, were exhibited at the Foundry and Machine Exhibit, at the National Amphitheatre, Chicago, which was held September 5-11, 1914. This machine, it is stated, has a pure balanced rotary movement, giving positive displacement, and will compress air efficiently to 100 lbs. gauge pressure or over, in a single stage. It is also cooled entirely by air, yet, it is claimed, has a lower temperature rise when compressing at high pressures than the best single-stage water-cooled compressors. The first model was successfully tested at the University of Michigan in May, 1912, and has just been placed on the market. Points of commercial interest mentioned are: great reliability and long life—made possible by the rotary principle and efficient cooling; high and sustained efficiency—large delivery of air with low power consumption; great flexibility—light and compact, extremely portable, requires no heavy foundations and no water piping; steady flow of air; uniform running and low

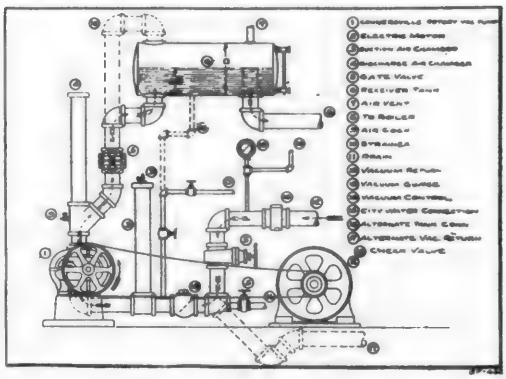


OPEN DECK TYPE THERMOFAN SUPPLYING WARM AIR TO LIVING QUARTERS.

starting torque, permitting direct connection to high speed electric motor, with refinement of control; efficiency at all speeds up to maximum, etc.

STURTEVANT TURBINE DRIVEN PUMPS for boiler feed and fire service, central stations, power houses, mines and contractors' work are announced in new circular matter issued by the B. F. Sturtevant Co., Hyde Park, Mass., and the company states that it is now prepared to supply such apparatus regularly. A pump of any good standard make will be supplied. The circular states that its catalogue No. 21050 describes these turbines in detail and shows some typical pumping sets.

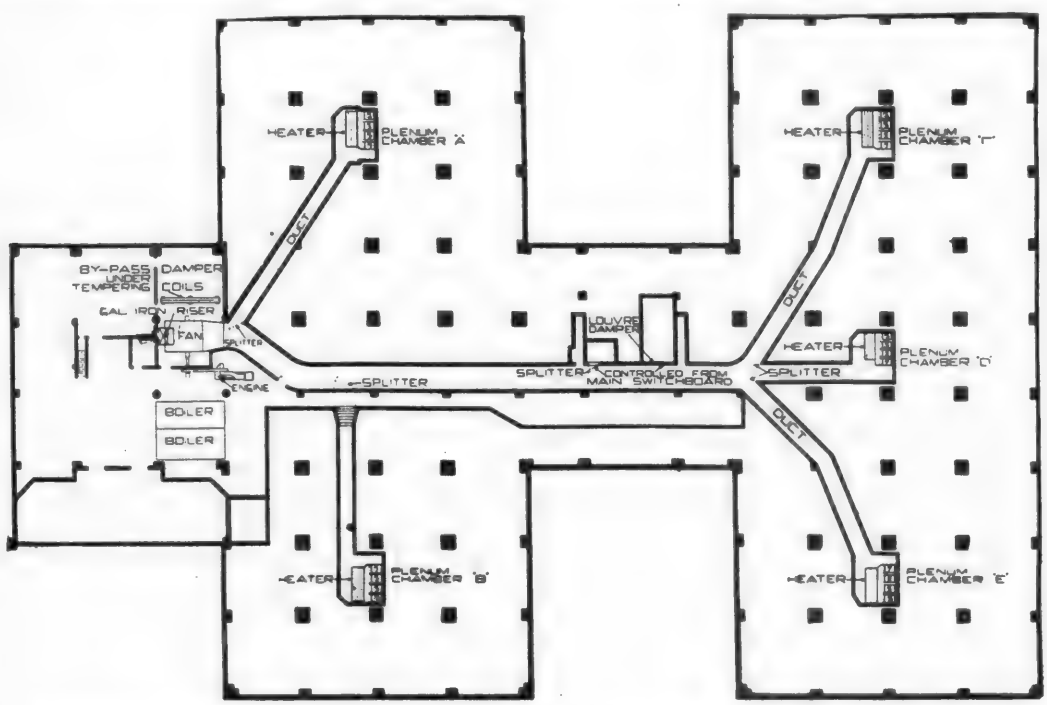
CONNERSVILLE VALVELESS VACUUM PUMP, designed especially for vacuum heating work, and made by the Connersville Blower Co., Connersville, Ind., is the subject of a new bulletin, in which attention is called to the fact that this pump is the improved form of the Cycloidal pump which has been manufactured by this company in sizes up to 1,200 gals. per revolution, since 1893. This pump, therefore, it is pointed out, has all the improved features resulting from these years of experience in rotary pump construction. In addition to views of the pump itself and its interior construction, which is remarkable for its simplicity, the illustrations include typical diagrams of installation, one showing an installation using a standpipe, another using a return tank and a third using a receiver tank.



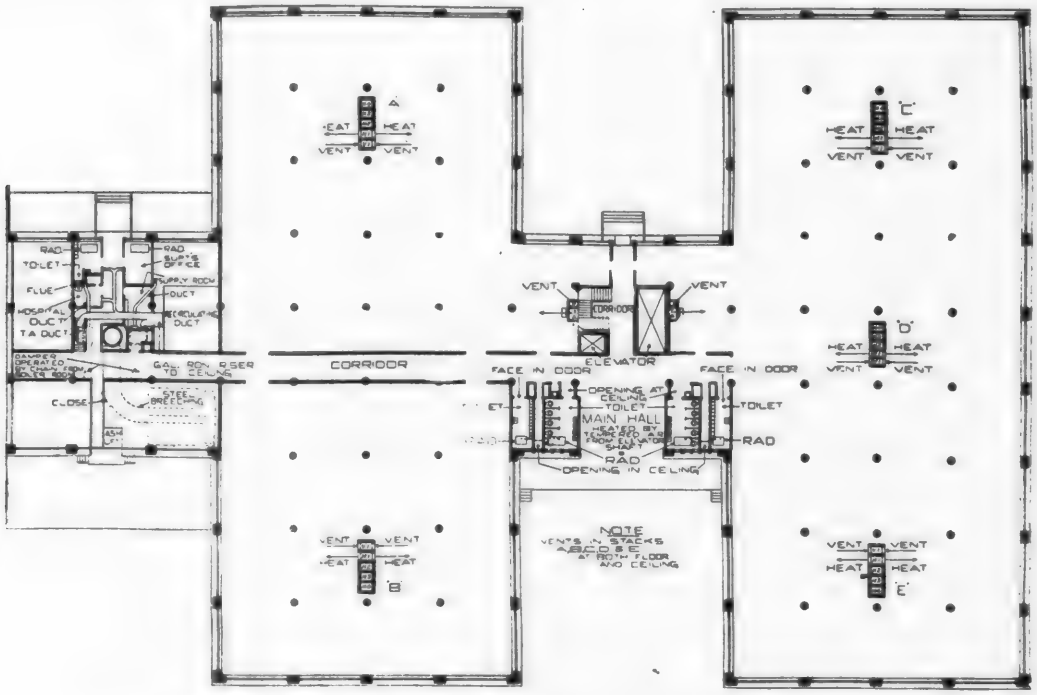
ARRANGEMENT OF CONNERSVILLE VACUUM PUMP IN HEATING SYSTEM—USING RECEIVER TANK.

The accompanying text gives a detailed explanation of each layout. The usual data are included for the guidance of the engineer, such as sizes, capacities, speed, etc., and appended is an impressive list of fifty installations in almost every type of building. Size 8½ x 11 in. (Standard). Pp. 4 (punched for binding).

SIROCCO SYSTEM OF HEATING AND VENTILATING in Toledo's Crystal Palace for manufacturing purposes has been made the subject of a special bulletin by the American Blower Co., Detroit, Mich. The illustrations include reproductions of the basement and typical floor



BASEMENT PLAN, TOLEDO FACTORIES COMPANY—SHOWING INSTALLATION OF HEATING SYSTEM.



TYPICAL FLOOR PLAN, TOLEDO FACTORIES COMPANY.

plans showing the heating equipment, also a view in the machine department of one of the companies occupying the building, showing the location of the fresh air supply and vent openings. With the walls practically all glass and housing thirteen separate manufacturing concerns in various size spaces, the building, it is stated, is one exceedingly difficult to heat properly. Included in the bulletin is a letter from the Toledo Factories Company, testifying to the satisfaction obtained with the system as installed, in spite of the fact that "trouble has been freely predicted by the advocates of older heating methods." Size 8½ x 11 in. (Standard). Pp. 8.

C. A. Dunham Company Not to Move.

In reference to a report printed in a Youngstown, Ohio, paper and published in our columns last month, to the effect that the C. A. Dunham Co., of Marshalltown, Iowa, manufacturer of the Dunham steam trap and vacuum heating specialties, was considering the removal of its plant to Youngstown, we are advised by the C. A. Dunham Company that "we have never contemplated or even thought of moving our plant away from Marshalltown. We have a factory and office building in Marshalltown of fireproof construction that represents a tremendous investment and under no circumstances that we could possibly think of could we be induced to move away. The location is central at an excellent shipping point and in every way is satisfactory." We are glad to make prominent correction of this erroneous report.

A Hearing to Be Held on Specifications for Steam Boilers.

A hearing of all interested and concerned in the preliminary report of a committee of the American Society of Mechanical Engineers on standard specifications for the construction of steam boilers and other pressure vessels and for the care of same in service will be held September 15, 1914, in the rooms of the mechanical engineers' society, 29 West 39th street, New York. A tentative draft of a standard specification was presented at the society's spring meeting in St. Paul-Minneapolis, June 16-19.

Asbestos Business Growth in Los Angeles.

That eastern manufacturers are finding an excellent market for their materials in the West is shown by the interesting new illustrated catalog of the American Heating and Construction Company of Los Angeles. In prominent buildings, such as the Merchants National Bank, W. I. Hollingsworth Building, Stillwell Hotel, and Auditorium Hotel, J-M pipe coverings are used. The Hotel Clark boasts of a couple of miles of J-M asbestocel on the risers and other connections. Both of these materials are among the products of the H. W. Johns-Manville Co., New York.

Death of Albert B. Franklin.

Albert B. Franklin, head of the heating and ventilating firm of A. B. Franklin & Co., Boston, Mass., and for many years prominently identified with the heating trade, died suddenly August 22 at the Melrose Hospital, near Boston, following an operation for appendicitis. He was 62 years old. Mr. Franklin had all his business life been connected with the steam fitting industry. He entered the employ of J. J. Walworth & Co., of Boston, in 1870, where he learned his trade. In 1878 he went in business for himself and built up a firm that was known as one of the largest and most important in New England, having installed the heating and ventilating equipments in some of the largest public and business buildings in that section, including the State House in Boston. Mr. Franklin was a member of The American Society of Heating and Ventilating Engineers. He served on the board of governors from 1905 to 1908, was elected second vice president of the society in 1911 and first vice president in 1912. At the time of his death he was a member of the board of governors of the Massachusetts chapter of the society. He was also a past president of the National Association of Master Steam and Hot Water Fitters.

Mr. Franklin was a member of the Middlesex Club, the Men's Congregational Club, Bethlehem Council, the Royal Arcanum, Knights of Pythias and Garfield Lodge, A. O. U. W. He is survived by a widow and six children. His two sons, Laurence and Ralph Stowell Franklin, who have been associated with him, will continue the business.

The Question of Garbage Disposal.

The city councils of various municipalities, city and State boards of health, health officers generally and improvement societies, have been spending considerable time during the last few months agitating the question of garbage disposal. Much attention is given to considering the various methods of destroying garbage and refuse away from the place where it originates, while too little, or no attention at all, is given to the disposal of garbage at the place of its origin.

Manifestly, the cleanly way of disposing of garbage is by incineration. And if the garbage is destroyed through burning while it is still fresh and untainted, it is a big advantage.

There is a very important point in favor of the destruction of garbage at its place of origin. One ton of garbage contains, in heat value, the equivalent of 200 lbs. of coal. Hence, garbage is worth as fuel, one-tenth of the price of coal. Therefore, the owner who has his garbage hauled away is actually giving away good heat producing matter. In some cases he must pay to have it hauled away.

One big stey toward the final solution of the garbage problem is undoubtedly the installation of garbage burners, in restaurants, hotels, hospitals, apartment buildings and larger residences. Obviously the apartment building containing two, four, six or more families is a large producer of garbage. And figures have been compiled which prove beyond any doubt that a law compelling apartment owners to install garbage burners would be not an imposed hardship but an imposed economy upon the owner.

The problem of garbage disposal and the problem of hot water supply have become strangely related. There are today on the market several types of garbage burners which will satisfactorily burn garbage and refuse and at the same time use the garbage as fuel for heating water for domestic purposes.

The Maryland Hotel, St. Louis, installed a garbage burner a year or more ago. This hotel has 125 baths, 255 washstands and kitchen facilities large enough to take care of 1,000 people. Their statement is that this garbage burner not only supplies them all the hot water they use, but burns all the rubbish and trash, about twenty barrels per day, at a cost of 65 cents per day.

Further opportunity for the economical use of a garbage burner of this type is shown in the installation of a water heating garbage burner in the ten-story and basement building, owned and occupied by Messrs. Lewis & Conger, New York City. The entire basement of this building is used as a shipping and receiving room, in the boiler room of which is placed a garbage burner connected to a horizontal storage tank of 250 gals. capacity.

The burner is used to consume the waste material accumulating around the shipping, packing and receiving rooms, and this refuse, used as fuel, with the addition of 150 lbs. of coal per day, furnishes sufficient heat to supply the entire building with hot water. This building requires about 2,500 gals. of hot water per day. The amount of heat required to raise the temperature of that amount of water 150° F. is approximately 3,200,000 heat units. In 1 lb. of coal there are about 8,000 heat units; therefore, the 150 lbs. of coal used supply 1,200,000 of the 3,200,000 heat units wanted. Therefore, the garbage, waste, straw, hay and paper used in the garbage burner provide two-

thirds of the fuel necessary to heat all the water used in this building.

In other words, the waste material consumed is equivalent in value to from 250 to 300 lbs. of coal. A fair average price of coal in New York is $6.50 per ton, which makes it a fair figure to estimate the worth of this waste matter used from a fuel standpoint at from 82 to 90 cents per day. In this case the value is really three-fold. The rubbish, old papers, etc., are gotten out of the way, necessary hot water is heated and the fire risk is greatly reduced.

It would, of course, be folly to recommend the installation of a garbage burner in every establishment, but there is absolutely no doubt that in a great many establishments, and this is possibly always true in the case of apartment buildings, a garbage burner would eliminate the garbage and at the same time effect an economy for the owner in reducing the cost of the hot water which he must furnish his tenants.—Elmer S. Leffel in Municipal Engineering.

PATTERSON COMBINED HOT WATER HEATER AND STORAGE TANK FOR SILK DRYING AND FINISHING PLANT.

Notable Hot Water Heater Installation.

One of the latest installations reported by Frank A. Patterson & Co., 26 Cortlandt St., New York, is that of a Patterson combined hot water heater and storage tank which is being placed in a large silk drying and finishing plant. The outfit is 10' ft. in diameter by 20 ft. long and contains a storage capacity of 10,000 gals. Its hourly heating capacity is 30,000 gals. of water raised from an initial temperature of 50° F. to 212° F., using live steam under automatic control. One of the notable features of this heater and storage tank is its special rust-proof lining, preventing any discoloration of the water. The manufacturers state that this is only one of many heaters installed for purposes of this sort throughout the country.

To join the ranks of the trade paper subscribers is to link hands with the most positive force of our time, to become a well drilled, well informed citizen, radiating energy and power.

Unification—oneness, fraternity, co-operation, mutual helpfulness; this is the flag we must raise and carry onward and upward.

Salem Conflagration Gives Lesson in Fire Prevention.

The terrible conflagration at Salem, Mass., on June 25, in which $15,000,000 worth of property was destroyed and a quarter of the population rendered homeless, is another striking example of the destruction which so often follows the breaking out of a fire among buildings constructed and roofed with inflammable materials.

The fire started in the midst of a factory district where the buildings were of wood. These almost instantly burst into flame. The

blaze ate its way within a few hours to the center of the business district. At the same time another section of the city a mile away was set in flames by embers carried by the wind and falling upon wooden shingled roofs.

Paterson, N. J., in 1902 had a similar disastrous fire experience. Here again it was the readily ignited materials used in the construction of the buildings, and especially roofs, which aided the rapid spread of the flames. The only type of construction which acted as a barrier to the fire was brick walls laid in Portland cement. Tarred roofs only added ready fuel and easily took fire where brands fell upon abraded portions from which the gravel had been worn.

After this experience, the city of Paterson passed an ordinance prohibiting the use of wooden shingles or inflammable roof coverings within the city limits. Since that time in Paterson and suburbs more than two thousand roofs have been covered with asbestos shingles and asbestos ready roofing.

The efficiency of asbestos roofing as a fire stop is illustrated by the fact that, in the Salem fire, sparks and burning embers were literally showered upon the roof of the Naumkeag Steam Cotton Company's storehouse; yet this building was absolutely unharmed because protected by J-M asbestos roofing, while other buildings all around it were burned to the ground.

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TRADE AND MISCELLANEOUS NOTES

Coming Events.

Third Monday in Each Month—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, Engineering Societies' Building, 29 West 39th St., New York (evening), commencing with October 19.

Second Monday in Each Month—Meeting of the Illinois Chapter, American Society of Heating and Ventilating Engineers, in Chicago (evening), commencing with October 12.

Second Tuesday in Each Month—Meeting of the Massachusetts Chapter, American Society of Heating and Ventilating Engineers, in Boston (evening), commencing with October 13.

Deaths.

Walter P. Warren, president of the Fuller & Warren Co., Troy, N. Y., manufacturers of stoves, etc., died August 8 at his home in that city. He was 73 years old. Mr. Warren has been identified with the stove industry since 1864 and had been president of the Fuller & Warren Company since 1890. He was a former president of the National Association of Stove Manufacturers. Mr. Warren was also prominent in civic affairs and through his colonial ancestry was identified with a number of colonial societies. He was a member of the Union and Manhattan Clubs, in New York. He is survived by a widow and three sons, William Henry Warren, Walter Phelps Warren, Chester Ingersoll Warren, and one daughter, Mrs. Thomas Vail.

Charles A. Carothers, general sales manager of the Standard Sanitary Mfg. Co., Pittsburgh, Pa., died suddenly August 8, at Cleveland, O., from blood poisoning. He was well known in the heating and plumbing trades.

Miscellaneous Notes.

Springfield, O.—Holding that an emergency existed which warranted the school board in dispensing with advertisements for bids for the heating and ventilating work in the Gray Hill and McKinley school buildings, Judge C. H. Kyle, sitting on the common pleas bench, dissolved a temporary injunction that had been obtained by a taxpayer designed to hold up the work.

Huntington, Ind.—A proposed ordinance giving the Huntington Light & Fuel Company permission to extend its line of steam piping for heating purposes on certain streets and alleys of Huntington has been filed in the office of City Clerk H. L. Young.

Ogden, Utah.—A large central heating plant is to be built at the rear of the Dee-Eccles Building to supply heat to three of the largest structures in the city, the Alhambra Theatre, the Col. Hudson Building and the Dee-Eccles Building. The buildings all join each other at 24th street and Hudson avenue.

Iowa Falls, Ia.—In connection with the electric light and hot water heating franchise which was granted some months ago to Cedar Rapids parties, it was understood that a new plant would be built at Iowa

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

PIPE CUTTERS

PIPE MACHINES, HAND OR POWER

The Tools of Constant Service

Manufactured by **Write for Catalog**

THE ARMSTRONG MFG. CO., 321 Knowlton St., BRIDGEPORT, CONN.

Falls or the old electric light plant bought and remodeled. It now appears that litigation involving the old plant is holding up the project. According to a statement made by John A. Reed, it is not probable any action will be taken on the franchise until the present litigation is cleared up.

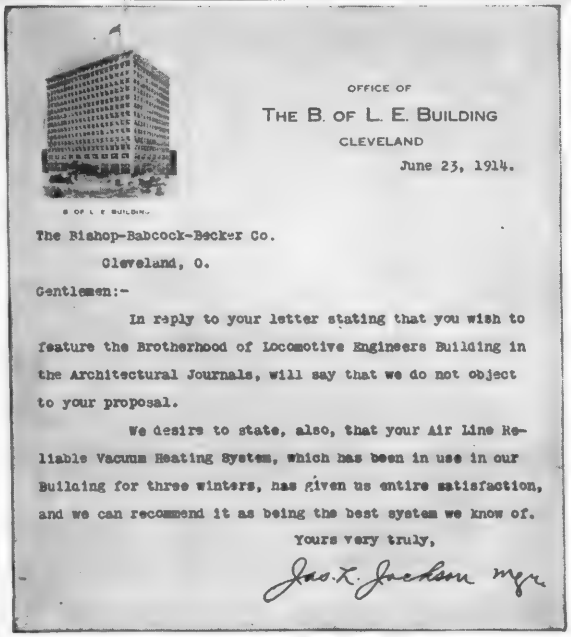
Clarence M. Woolley, president of the American Radiator Co., Chicago, who was in Paris when the European war broke out, has decided to remain in Paris for the present and is occupying quarters which have been arranged for him on the top floor of the company's Paris office.

Hoboken, N. J.—The Hoboken Land and Improvement Company announces plans for the construction of three 12-story factory buildings, with modern heating and plumbing equipment, at Washington and 15th streets, Hoboken. The building will cost $1,000,000.

Hamilton, Canada.—The plant of the Berlin Central Heating Company has been purchased by a syndicate of Toronto men headed by C. H. Thompson, who will take charge. It is proposed to double the present equipment and increase the patronage along streets where mains have been laid.

Burlington, Ia.—In an announcement made by Manager Charles H. Walsh it was definitely stated that the local central heating plant would be abandoned, owing to the installation of the electric power station at the Keokuk dam. There were 110 patrons of the central heating plant. A petition was circulated among them asking the company to continue on the basis of a 50 per cent. increase in the rates, but only seven signatures were secured. All those who have been using city steam are now obliged to install individual heating plants in their buildings. The passing of the heating plant marks the end of an industry in Burlington which was established by the Burlington Steam Supply Co. in 1882.

South Bend, Ind.—A new proposition for a heating franchise in South Bend in favor of the St. Joseph Heating Co., a subsidiary of the Indiana and Michigan Electric Co., was submitted at a meeting of the board of works, held July 16, by F. A. Bryan, general manager of the company. The new proposition provides for certain franchise charges, the city's proposal being 2½ per cent. for the first five years and 5 per cent. thereafter of the gross income. Instead of a 10-year term as proposed by the city or a 50-year term as proposed by the heating company, the term is to be 30 years with the reserved privilege vested


OFFICE OF
THE B. OF L. E. BUILDING
CLEVELAND
June 23, 1914.

The Bishop-Babcock-Becker Co.
Cleveland, O.

Gentlemen:-

In reply to your letter stating that you wish to feature the Brotherhood of Locomotive Engineers Building in the Architectural Journals, will say that we do not object to your proposal.

We desire to state, also, that your Air Line Reliable Vacuum Heating System, which has been in use in our Building for three winters, has given us entire satisfaction, and we can recommend it as being the best system we know of.

Yours very truly,

Jas. K. Jackson Mgr.

Read this letter

from the manager of this modern office building—one of the largest and finest in the World. The Reliable Vacuum Heating System has given entire satisfaction because it insures even heat distribution, instant results and great fuel saving. The system is noiseless; and there is no vapor escape; no leaky radiator valves; no odors or gases; no adjustments necessary.

RELIABLE
VACUUM HEATING SYSTEMS

are giving just as good results in hundreds of other buildings of all kinds, large and small, throughout the country.

Our catalog explains why these results are possible. Write for a copy, today, of Booklet "A."

THE BISHOP-BABCOCK-BECKER COMPANY
General Offices: CLEVELAND, O.

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in the city to purchase the heat distribution plant after 10 years at two-thirds its appraised value.

Dunkirk, N. Y.—By taking $35,000 stock of the newly-organized Continental Heating Company, Dunkirk citizens have assured for that city the plant of the company, which will be devoted to the manufacture of heating boilers and radiators.

Philadelphia, Pa.—Dr. R. H. Harte, director of the department of health and charities, has characterized the Philadelphia City Hall as one of the poorest ventilated buildings in Philadelphia. He recommends that the four large stair towers which, he contends, are "hermetically sealed," be converted into air shafts for proper ventilation.

Compressed Gas Manufacturers' Association advises us the manufacturers of valves, cylinders, recording gauges, filling and weighing stands and all material and appliances which enter into the manufacture, transportation and sale of compressed gases, are requested to regularly send catalogues, price lists and full descriptive details to the association's headquarters at 23 Madison avenue, New York.

Manufacturers' Notes.

H. W. Johns-Manville Co., New York, announces the removal of its Duluth, Minn., office to 327 West Third Street, that city.

Richardson & Boynton Co., New York, whose boiler plant at Dover, N. J., was recently damaged by fire, announces that it has let the general contract for the erection of several new factory buildings at Dover which will give the plant a greater output than ever.

Moline Vacuum Vapor Heating Co., Moline, Ill., has moved its Chicago office to larger quarters in the Peoples Gas Building, Room 1328.

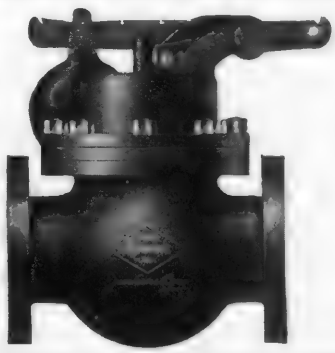
Crane Co., Chicago, Ill., announces that Charles R. Crane, who succeeded his father, R. T. Crane, as president of the company, has retired from the presidency and has been succeeded by his brother, R. T. Crane, Jr. Other changes announced by the company are: First vice-president, J. B. Berryman; second vice-president and treasurer, A. D. MacGill; secretary, E. H. Raymond; assistant treasurer, R. B. Stiles.

E. C. Molby, under whose name the Surrell down draft boilers are now being sold, announces that the plant at Tatamy, Pa., where these heaters are made, is being enlarged by the addition of a four-story machine shop.

Central Brass Mfg. Co., Cleveland, O., has increased its capital stock from $100,000 to $150,000.

Automatic Ventilator Co., New York, has filed suit against the Jewett Car Co., Newark, N. J., alleging patent infringement.

Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., will be reorganized on the following basis, if the plans discussed at a meeting of the reorganization committee August 3 are carried out. The creditors



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"JENKINS BROS. VALVES, with the DIAMOND TRADE MARK"

and your clients will be certain to obtain good service.

The Jenkins Bros. line includes radiator valves of all kinds, and globe, angle, check, back pressure, automatic equalizing stop and check, blow-off—in short, about every type required in the modern power plant. Write for our handy catalogue.

JENKINS BROS. New York Chicago Boston Montreal Philadelphia London

SPECIFY FOXBORO THERMOMETERS

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THE LATEST AND BEST BY EVERY TEST Send for Bulletin No. 73

New York 50 Church St. **The Industrial Instrument Co., Foxboro, Mass.** Chicago Monadnock Bldg.

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to receive 40 per cent. in cash, also a note to be made by the new Kellogg Company in the amount of 15 per cent., payable December 15, 1915, and two notes of the new Pierce Company, one maturing December 15, 1916, and one maturing December 15, 1917, all notes bearing 6 per cent. interest, the balance of 25 per cent. to be paid in preferred stock of the new Kellogg Company. The reorganization committee is composed of the following: Richard L. Austin, president, Gerard National Bank, Philadelphia, Pa.; Herman Waldeck, vice-president, Continental & Commercial Bank, Chicago, Ill.; W. D. Campbell, banker, New York; Chas. H. Sanford, president, National Bank of Syracuse, N. Y.; Theodore Ahrens, president, Standard Sanitary Mfg. Co., Pittsburgh, Pa., and Acosta Nichols, a partner in the Spencer Trask & Co., New York City. The proposed directorate of the new company comprises Theodore Ahrens, president, Standard Sanitary Mfg. Co.; Richard Garlick, treasurer, Youngstown Sheet & Tube Co., Youngstown, Ohio; M. J. Alexander, vice-president, Pittsburgh Valve & Fitting Co., Pittsburgh, Pa.; C. V. Kellogg, president, Kellogg-Mackay Co., Chicago, Ill.; Acosta Nichols, Spencer Trask & Co.; Dr. J. T. Duryea, president, Colwell Lead Co., New York City; and a resident of Syracuse, N. Y., not yet selected. The sale of the company's assets, which was postponed from August 4, was scheduled for August 25.

New Firms.

J. J. Houlihan & Co., Chicago, Ill., has been organized by J. J. Houlihan, who was for many years with the L. H. Prentice Co., of that city. The new firm will engage in the contracting business for the installation of heating, ventilating, cooling and power plants.

New Incorporations.

New England Radiator Co., Kittery, Me., capital stock $10,000, to manufacture, sell and deal in radiators, etc. Incorporators: William W. Phillips, president and treasurer; Horace Mitchell.

General Heating and Ventilating Co., Milwaukee, Wis., capital $30,000. Incorporators: James T. Drought, B. Brady and C. Lachmund.

Turner Plumbing Co., Chester, Pa., capital $12,000, to deal in heating and plumb-

What would you say —

if it were proved that every drop of condensation in your steam apparatus can be returned to your boiler as feed water without a pump— and at a temperature up to 330 degrees Fahr.? Sounds pretty good, doesn't it? It can be done, too,—with the

Costs but a fraction of what it saves

Morehead Back to Boiler SYSTEM

Produces more steam from less coal

The quickest, surest and most satisfactory way of convincing you that the "Morehead" does all this and more is to install it in your plant. Our engineers can give you stacks of proof and help solve a lot of your steam difficulties.

Write for complete information—to-day

MOREHEAD MFG. CO., DETROIT, MICH.

HEATING DEPT.

229

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

A Good Looking Radiator Valve

Ordinary radiator valves—even when new—are never particularly graceful or ornamental in appearance. In time they become a jarring note in any well decorated room.

The indifferent finish becomes tarnished, discolored and streaked by the leakage of oily and rusty water from within the system. The recess in the handle fills with dirt—the handle often cracks, splits and eventually comes off. A glance at the average valve will generally show an unsightly condition.

Genuine Detroit Packless Radiator Valves are beautiful. Their lines are substantial, symmetrical and pleasing. The metal surfaces have a smooth, satin finish never before approached, even, in radiator valve construction. This finish—the result of secret processes—will not deteriorate. And the valves cannot leak.

The handles are large, nicely proportioned and smooth. The beautiful mahogany finish is easily kept in good condition and there is no recess in the top to harbor dirt.

Detroit Packless Valves are made to accord and harmonize with the most beautiful surroundings and to retain that appearance always. They are a strictly quality product in every way and as such are inducing favorable comment wherever they have been installed.

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY LTD. WALKERVILLE, ONTARIO, CANADA

ing specialties. Incorporators: Samuel C. Turner, Nellie T. Randle, William H. Turner.

Bernard Lichtenberg Plumbing & Heating Co., Passaic, N. J., capital $25,000, to conduct a heating and plumbing contracting business. Incorporators: B. Schramm, M. Schramm, Mary Lichtenberg and B. Lichtenberg.

Conrow Plumbing Co., Racine, Wis., capital $5,000. Incorporators: Herbert E. Palmerton, John B. Simmons and M. E. Walker.

Hosford Plumbing & Heating Co., New York, capital $25,000. Incorporators: L. D. Hosford, W. H. Mathews and T. S. Hinton.

Continental Heater Co., Dunkirk, N. Y., capital $150,000, to manufacture radiators and other steam heating apparatus. Incorporators: Horace S. Gould, New York; John S. Stearns and Charles S. Ruebling, Chicago.

J. H. Wiggins Co., Willmar, Minn., capital $25,000, to conduct a contracting business in heating and ventilating, lighting and plumbing.

Geissler & Murphy, New York, capital $5,000, incorporated to take over the heating and plumbing business of Geissler & Murphy. Incorporators: P. Geissler and E. Geissler, of New York; J. F. Murphy, Harrison, N. Y.

Decker Mfg. Corporation, Brockfort, N. Y., capital $26,200, to manufacture heating and lighting fixtures, etc. Incorporators: Charles Decker and Margaret M. Harris, Brockport.

Pittsburgh Specialty Mfg. Co., Pittsburgh, Pa., capital $50,000, to manufacture and deal in malleable and cast iron, cast steel and aluminum. Incorporators: Edward J Dugan, Jeannette, Pa.; Bernard J. Dugan, Pittsburgh; and Felix H. Kane, Greenley, Pa.

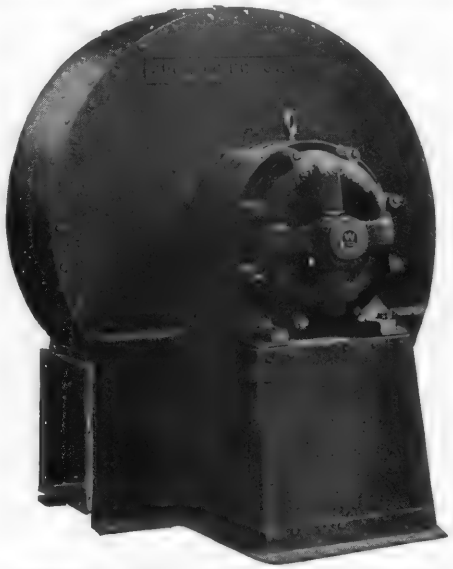
National Flue Blower Corporation, New York, capital $25,000. Incorporators: H. S. Fitzgibbon, P. M. Maresi and R. W. Crawford, 52 Broadway, New York.

Southern Heating and Plumbing Co., Houston, Tex., capital $4,000. Incorporators: L. G. Smith, T. W. Walker and others.

Current Electric Co., Chicago, Ill., capital $60,000, to manufacture electric heating appliances. Incorporators: C. R. Barrett, B. Levering and others.

Gollos Automatic Car Heating Co., Chicago, Ill., capital $75,000, to manufacture railway heating devices. Incorporators: A. Gollos, R. W. Reynolds and M. H. Cohen, all of Chicago.

Vehorn-Osterfeld Plumbing Co., Dayton, O., capital $10,000, to conduct a heating



Westinghouse Alternating-Current Motor Driving Steel-Plate Fan

To insure reliable and economical operation, specify

Westinghouse Electric Motors

for driving ventilating fans and blowers.

A complete line of alternating and direct-current motors especially designed for ventilating service.

Quiet in operation.
Compact in design.
Require practically no attention.
Do not drip oil.
Very economical in the use of current.
Extra strong shafts and bearings.

Send for full information.

Westinghouse Electric & Mfg. Company
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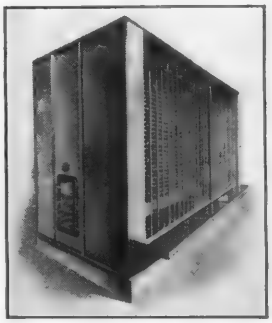
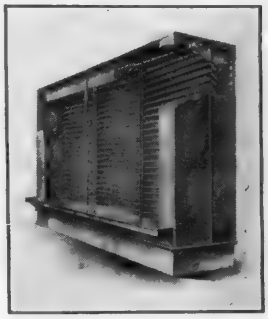
Sales Offices in 45 American Cities



Webster "Type A" Air Washer

WEBSTER Air Conditioning APPARATUS

is designed and built to meet the individual requirements of each installation.



Webster "Standard" Air Washer

NO ONE TYPE of apparatus is best suited for all kinds of service, but for each condition such as Air Cleansing, Air Cooling, Humidifying, etc., there is a type of Webster Air Conditioning Apparatus that is most effective for the specific service.

For this reason more satisfactory results can be secured than is possible with a type that has been designed in an attempt to meet all conditions.

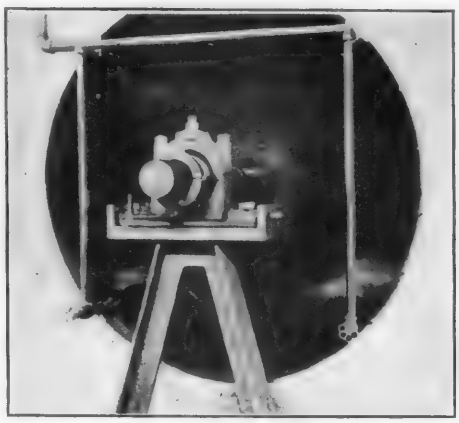
While Webster Air Conditioning Apparatus is made in several types, each type is of the same high class design—constructed of the same high class material and workmanship—a standard that is always maintained.

Consult us before writing your next specification.

WARREN WEBSTER & COMPANY, CAMDEN, N. J.

Established 1888 **24 Branch Offices**

NINE SPECIAL FEATURES OF THE ZELLWEGER AIR WASHING AND COOLING FAN



Zellweger Air Washing and Cooling Fan (Patented) in operation showing distributing and sprinkling pipes, water-spreaders and sprays.

1. Requires only as much space as an ordinary centrifugal fan of equal capacity.
2. Can be installed in suitable units in any part of a building.
3. Blows more air than a standard centrifugal fan.
4. Furnishes more air for equal power than older forms of air washer with any kind of fan.
5. Purifies and cools air more than earlier forms of air washers.
6. Self-cleaning.
7. Four apparati combined in one—blower, purifier, eliminator, circulator.
8. Can be applied to any centrifugal fan.
9. Perfects warm air heating systems and enlarges them into cooling systems.

OUR CATALOGUE GIVES FULL DETAILS

J. ZELLWEGER & SONS

1900 Adelaide Avenue **St. Louis, Missouri**

and plumbing business. Incorporators: Charles J. Vehorn, H. J. Osterfeld, Anna Vehorn, Barney Osterfeld and Fred Schmitz.

Robertshaw Mfg. Co., Pittsburgh, Pa., capital $25,000, to take over the heating specialty business heretofore conducted under the same name. Incorporators: Frederick W. Robertshaw, Pittsburgh; Lincoln D. Robertshaw and G. A. Robertshaw, Youngwood, Pa.

Contracts Awarded.

Bryce Heating and Ventilating Co., Toledo, O., heating and ventilating high school building at Hartford City, Ind., for $21,012. This contract had been previously awarded to the Hoosier Warming and Ventilating Co., Muncie, Ind., and it was stated that the Hoosier company was so busy that it could not do the work. The only other bidder was the W. H. Johnson Co., Indianapolis. The work includes the heating and ventilating of the high school, north and west side buildings. The first two are to be heated from a central plant near the high school building, while the west side building will be heated by furnaces to be taken from the other buildings.

Robert Graham, Riverpoint, R. I., heating new Natick School for $3,057.

J. C. Hurley Co., San Francisco, Cal., steam heating new Katz Building, at California and Hyde Streets, that city.

McKay-Navarre Plumbing & Heating Co., Seattle, Wash., heating and plumbing Minor School for $7,535. Other bids were: Ernst Hardware & Plumbing Co., $7,598; P. J. Glennon Plumbing Co., $8,310; D. H. King Plumbing & Heating Co., $8,626; Norton & Smith Plumbing Co., $8,278; Rautman Plumbing & Heating Co., $9,011; Wentzler & Ward, $7,700.

J. J. Powers Co., Brockton, Mass., heating and ventilating Huntington School at Brockton, for $19,878. Other bids were: J. T. Corcoran, $23,380; J. E. Holland, $24,554.

N. J. Smith, Worcester, Mass., heating and ventilating Millbury Street School in Worcester, for $4,735.

M. D. Holmes & Son, Worcester, Mass., heating and ventilating Centerbury Street School in Worcester for $2,695.

M. A. Dame & Sons, Lynn, Mass., heat- and ventilating English High School annex at Lynn for $9,594.

Fentzlaff Heating & Plumbing Co., Montclair, N. J., steam heating and plumbing new Mountainside Hospital at Montclair, N. J.

W. E. Lape, Syracuse, N. Y., heating and ventilating and plumbing, new Y. M. C. A. building at Watertown, N. Y., for $16,500; also similar equipment for the College of Forestry at Syracuse University at its bid of $15,500.

Arthur W. Murray Co., Hoopestown, Ill., heating and plumbing high school in Fairbury, Ill., for $13,000.

Carson-Payton Co., Danville, Ill., heating, plumbing, etc., for the new buildings at the Oakland Shops, in Danville.

J. J. O'Keefe, Muscatine, Ia., heating and plumbing new city hall at Muscatine, for $6,000.

Modern Plumbing Co., Terrell, Texas., heating new city hall at that place.

W. F. Sheahan, Topeka, Kan., heating and ventilating and plumbing Grant School building for $3,084.

Allen, Myers & Co., Rock Island, Ill., steam heating and ventilating new Central Trust Bank building at Rock Island, for $14,000; also steam heating and plumbing First Methodist Episcopal Church at Rock Island, for $5,500.

Evarts & Overdeer, Lancaster, Pa., hot water heating new Bruswick Hotel building in Lancaster.

Trenton Plumbing & Heating Co., Trenton, N. J., heating and plumbing at power station of the Public Service Electric Co., at Burlington, N. J., for $5,000.

Power Heating and Ventilating Co., Boston, Mass., heating apparatus for the new laundry building for the State Hospital for the Insane at Howard, for $2,237. Other bids were: Rhode Island Supply & Engineering Co., Boston, $2,422; Isaac Coffin Co., Boston, $2,295.

Mansfield Plumbing Co., Passaic, N. J., heating and plumbing new office building for the Manhattan Rubber Co.

George McLeod, Clinton, Mass., heating and ventilating Walnut Street School in Clinton, for $2,907. Other bids were: R. Maitland & Son, $3,232; O'Toole Bros., $3,875.

M. D. Holmes & Son, Worcester, Mass., heating and ventilating new State Asylum, at Worcester, for $32,000. Seven buildings will be equipped.

Leitelt Iron Works, Grand Rapids, Mich., heating Perkins Building at Grand Rapids.

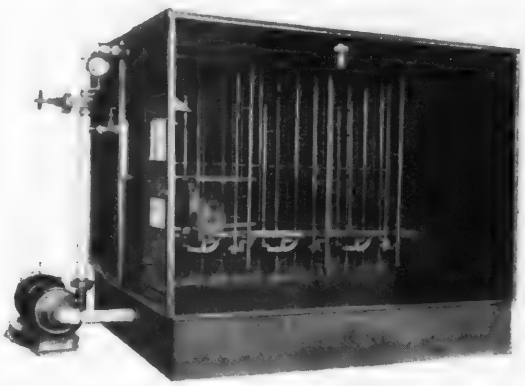
Scott Co., San Francisco, Cal., heating and plumbing Court of Abundance building at the Fair, for $5,440; also heating and plumbing Hawaiian Building; also heating Agricultural School Building at the University of California, Davis, Cal.

Oakland, Cal.—Bids were received as follows for the heating and ventilating of the Oakland Municipal Auditorium: Victor Engineering Co., $24,195; Siebert Co., $25,489; J. J. Hurley Co., $26,616; Robert Dalziel,

OVER 30,000,000

Cubic Feet of Air Each Minute Passes Through

ACME AIR WASHERS AND HUMIDIFIERS



Over 60,000 "Acme" spray heads can be automatically flushed four times per hour. Have you investigated Air Washers or let some salesman tell you about them? Go out and investigate the "Acme." You will find one in your city—either in the bank—theatre — department store — office building—school—or factory—possibly it is equipped with automatic humidity control, as a large number of them are. If not we will tell you how we do it.

Send for "Acme" Bulletin.

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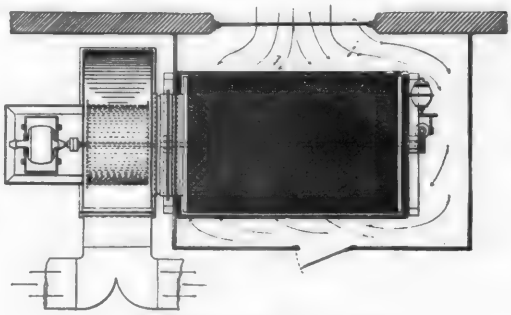
New York St. Louis Minneapolis Columbus Rochester And all principal cities



Patented April 13, 1912.
Plan View

The KINGWELTON Rotary Air Purifiers

Most efficient for cleansing the air and controlling humidity, removing not only the dirt and dust, but also bacteria and objectionable odors.

Adapted for all classes of buildings

The cost of operating this washer is very slight, taking nine-tenths less H. P. than any other purifier (example, a 50,000 cu. ft. purifier requires 1 H. P.).

A substantial test was made at the Pennsylvania Railroad Station, Pittsburgh, Pa., by the Railroad Company, where the local air is heavily filled with carbon from coal, and this washer removed 99% of impurities, depositing the carbon in the bottom of the tank for removal.

This apparatus is manufactured at our own works, size to suit conditions. Plans furnished for ventilating plants, with air purifier combined.

A FEW INSTALLATIONS.

NEW YORK CITY.	OTHER CITIES.
Singer Building.	Pennsylvania Depot, Union Station, Pittsburgh, Pa.
National Park Bank.	Pennsylvania Depot, Union Station, Washington, D. C.
Breslin Hotel	American Mfg. Co., Greenpoint, L. I.
Flat Iron Restaurant.	Independent Order of Foresters, Canada.
Residence of Mr. A. G. Jennings.	People's Gas. Co. Building, Chicago, Ill.

Write for descriptive Circular.

WELLS AND NEWTON COMPANY

Avenue B & 17th Street, New York City

Jr., $27,100; Peterson-Jones Co., $28,280; F. P. Walsh, $28,700; Scott Co., $28,790; Pacific Fire Extinguisher Co., $28,852; Bay Engineering Co., $29,333.

Kiernan & O'Brien, San Francisco, Cal., heating and ventilating new building for the San Francisco Labor Council, for $5,585; the plumbing contract went to Frank J. Klimm, at his bid of $3,550.

J. E. O'Mara, San Francisco, Cal., heating and plumbing new six-story building at Ellis and Jones Streets for $4,100.

Mangrum & Otter, San Francisco, Cal., heating and ventilating Clift Estate hotel for $60,000. The work is under way.

San Rafael, Cal.—Bids were received as follows for the mechanical equipment of the new Municipal Bath House, but were rejected as exceeding the appropriation: Kiernan & O'Brien, $11,533; Victor Engineering Co., $11,325; J. E. O'Mara, $10,750; American Machine Works, $9,999; Pacific Fire Extinguisher Co., $10,393; Peterson, James & Co., $9,500; J. C. Hurley Co., $8,960.

C. C. Hartwell Co., Ltd., New Orleans, La., heating and plumbing Sisters of Charity Hospital building at Pensacola, Fla., and the Texas office building in Houston, Texas.

W. C. Gibson Co., Louisville, Ky., heating and ventilating Grayson Street School for $2,263.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until Sept. 14, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Port Jervis, N. Y. One story, mezzanine and basement, 4,800 sq. ft. ground area.

Until Sept. 24, 1914, for the construction, including mechanical equipment, etc., of the U. S. Post Office at Mandan, S. D. One story and basement, 3,700 sq. ft. ground area.

Until Sept. 28, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office and court house at Amarillo, Texas. Three stories and basement, 5,500 sq. ft. ground area.

Until Oct. 6, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Uvalde, Texas. One story and basement, 4,700 sq. ft. ground area.

THE REAL ESTATE EDUCATOR

Containing inside information not generally known, 'Don'ts" in Real Estate, 'Pointers," **Specific Legal Forms for Sale, Exchange, Building and Suretyship Contracts, Bonds Mortgages, Powers of Attorney, Leases, Landlord's Agreements, Notice to Quit, Deeds, Chattel Mortgages,** etc. It gives in the most condensed form, the essential Knowledge of the Real Estate Business. What You Need to Know—What You Ought to Know—What You Want to Know About It, Placed at Your Fingers' Ends. How to Become a Notary Public or Commisioner of Deeds. This book is an inspiration to the indifferent and a stimulus to the ambitious. Apart from the agent, operator or contractor, there is much to be found in its contents that will prove of great value to all who wish to be posted on Valuation, Insurance, Measurements, Contracts, Mortgages, Leases and Evictions. The cost might be saved 500 times over in one transaction. 256 pages, cloth, postpaid, **$1.00.**

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"Garden City" Fans and Blowers

Have maintained a reputation of Quality for over 35 years. Our slow speed, power saving, noiseless Cycloidal fan, will make your ventilating work successful.

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The First Authoritative Handbook on District Heating

CENTRAL STATION HEATING

BY

BYRON T. GIFFORD

MEMBER AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS,
JUNIOR MEMBER AMERICAN SOCIETY OF MECHANICAL ENGINEERS

208 Pages, with 42 Figures, including 50 Pages of Miscellaneous Engineering Data

Size 6 x 9½ in., Bound in Flexible Leather

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CHAPTER I—IN GENERAL

Unit of Measure. Advantages of Central Station Heating.

CHAPTER II—PIPE LINE LOSSES

Loss from Radiation. Table of Square Feet of Surface in Pipe. Table of Unit Radiation Loss. Efficiency of Underground Covering. Loss from Leaks. Loss from Friction. Loss from Both Friction and Radiation. Pipe Capacity Tables. Value of Good Insulation.

CHAPTER III—PIPE LINE DESIGN IN GENERAL

Hot Water System. Steam System. Steam System (Return). Percentage of Line Loss. Map of One-Pipe Steam System. Map of Two-Pipe Steam System. Map of Multiple Water System. Map of Belt Water System. Comparison of Systems. Tunnel and Conduit Construction. Notes on Construction. Notes on Repaving.

CHAPTER IV—RATES IN GENERAL

Temperature Control. Heat Consumption Tables. Heat Pro-Rating Table. Maximum Demand Rate. Fixed Charges; Operating Costs.

CHAPTER V—THE HEATING STATION

Steam Systems. Water Systems. Boilers. Pumps. Reheaters.

CHAPTER VI—OPERATION AND MAINTENANCE

Pressure Required in Heating Mains. Pressure Required in Hot Water Mains. Regulating Flow of Water. Temperature Required in Hot Water Heating Mains. Schedule of Temperatures. Notes on Maintenance. Pipe Line. Station. Traps, Meters, etc. Percentage of First Cost.

CHAPTER VII—MANAGEMENT

Notes in General. New Business Department.

CHAPTER VIII—FRANCHISES

Notes in General. Outline of a Franchise. Steam and Hot Water Franchise. Steam Franchise. Hot Water Franchise.

CHAPTER IX—BUILDING EQUIPMENT IN GENERAL

How to Figure Radiation. Table of B. T. U. Emitted per Square Foot per Hour Through Various Materials. Percentage Curve. Data Sheet. Maps of United States Showing Average and Minimum Temperatures Recorded. Wind Effect. Location of Direct Radiators. Temperature Control. Pipe Covering.

CHAPTER X—MISCELLANEOUS DATA

This work presents the most advanced practice in central station heating, both steam and hot water, and is an invaluable guide, not only to the engineer, but to municipalities and public service commissions where district heating is being, or will be, used.

PUBLISHED BY THE

HEATING & VENTILATING MAGAZINE CO.

1123 BROADWAY, NEW YORK

Until Oct. 7, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Narragansett Pier, R. I.

Business Troubles.

International Steam Pump Co., New York, a $39,000,000 corporation, with plants and subsidiaries in a dozen centers, has been placed in the hands of receivers. This action was taken at the request of three creditors who brought a friendly suit in equity. The liabilities of the corporation are set forth in the complaint at $10,839,937, but of this amount $9,542,895 represents the bonded indebtedness. Inability to meet the maturing interest payments on the bonds is given as the direct cause of the receivership. It is stated that the receivership is not expected to involve any of its associated or subsidiary companies, the most important of which are the Henry R. Worthington Co., of Newark, N. J., the Blake & Knowles Steam Pump Works and the Power & Mining Machinery Co. The company's output consisted principally of steam and electric pumps, air compressors, gas engines, etc. A recent statement placed the assets at $52,000,000, which, however, cannot at present be liquidated without injury to the creditors. The company, it is expected, will be reorganized.

Trade Literature.

THE REVOLVATOR AND WHAT IS SAID ABOUT IT is the title of an attractive 24-page booklet recently issued by the N. Y. Revolving Portable Elevator Co., of Jersey City, N. J. It contains extracts from a large number of letters which have recently been received by this company, commenting upon the various uses to which the revolvator has been put in different industrial plants. All the letters are of recent date, and forcibly point out that tiering machines can be used to advantage in practically every kind of manufacturing plant. The book contains a number of illustrations showing the revolvator in use in plants from which the letters were received, and the book is worth reading by anyone who is interested in cutting down the cost of handling material and increasing the storage capacity of warehouses. Copies may be had by addressing the manufacturers at the address given.

VACUUM OIL SEPARATORS, for removing oil from exhaust steam under vacuum conditions, are described in a 24-page pamphlet lately issued by the Harrison Safety Boiler Works, 3189 North 17th St., Philadelphia, Pa. It is stated that the oil present in exhaust steam

INTERNATIONAL Economy Combination Heating System (Formerly called Pease-Economy)

The Satisfactory Solution of the Heating Problem

My home is quite a large one, situated on high ground with no protection from the northwest winds for many miles, making it for that cause more difficult to heat. I have found no difficulty in keeping the temperature of 70° or more throughout the whole house on any of the coldest days, with a pleasant, fresh heat. I have found the apparatus easier to manage than any I have ever used. W. D. BRACKETT.

SUPERIOR to the best steam heating plant because it supplies a perfect ventilating system.

¶Superior to a high-grade hot water apparatus because it does away with the big, ungainly radiators in the living rooms.

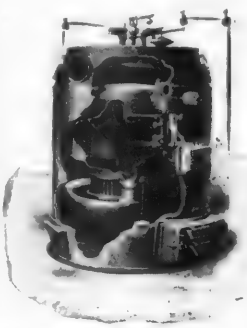
¶Superior to a first-class warm air furnace because it warms far distant rooms equally with those near.

¶Since a heating apparatus is installed with no expectation of replacing it for years to come, can you afford to recommend anything short of the very best?

¶Even if you have a prejudice, be open-minded enough to investigate the Economy System.

¶A postal brings our literature.

¶We are at your service to help solve particular problems.



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Catalogued in Sweet's, Page 1303

Buffalo house heated with **2 KELSEY WARM AIR GENERATORS.**

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The Kelsey is a HEALTHIZER and ECONOMIZER

IT delivers the freshest kind of fresh air heat—not hot, scorched air with the oxygen burned out of it, but large volumes of agreeably warmed fresh air. The kind that a physician will indorse without exception.

It's an economizer for the single reason that it delivers so large a quantity of **available** heat for every pound of coal. No furnace heat can approach it. Not even hot water can equal it, and you can heat any room in any weather when any wind is blowing.

If there isn't a **KELSEY** Dealer in your town, wouldn't you like the exclusive agency? Let's talk it over.

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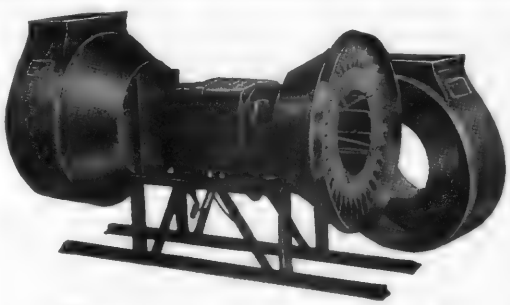
THE KELSEY
WARM AIR GENERATOR

Syracuse, N. Y., 303 James Street

New York,
103-F Park Ave.



Hackney System of Ventilation

Manufactured Exclusively by

The Hackney Ventilating Co.

MINNEAPOLIS, MINN.

The above cut shows one of the Hackney Noiseless Blowers, which when used in connection with their system of ventilation, fully covered by patents, is guaranteed to be the only system sold or made that will bring in the necessary amount of fresh air according to what the premises are used for, their area and the number of occupants, keeping them to almost a state of purity, which we are enabled to do, because we remove the same amount of foul air at the same time. All this is done without draughts or chills, causing sickness. You will observe we thus keep the air in perfect balance.

No other system, as you probably are aware, can do this. We can distribute anywhere between three thousand and ten million cubic feet of air per hour.

Our blowers, besides being noiseless, will give more air with less horse power than any other blower of equal dimensions, thus making our system specially suitable for churches, schoolhouses, theatres, etc.

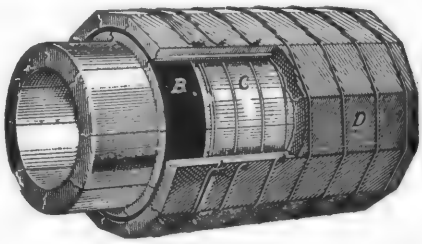
Write us for prices, catalogues, etc. Agents wanted.

exists in two forms; free oil, which will float to the top, and emulsified oil, divided into very small globules, some less than 1-200,000 of an inch in diameter. Because of their small size, such emulsified particles readily pass through the ordinary filters, which furthermore rapidly fill up with the free oil, so that unless removed frequently, large amounts of oil may escape into the filtered water. The mechanical method of removing the oil from the steam before it is condensed, by means of oil separators, is recommended, and it is claimed to prove highly efficient, less han ¼ to ½ grain oil appearing in a gallon of the condensate, provided oil of a suitable quality, which will not vaporize sensibly at steam temperature, is employed. The best oils for this purpose are said to be those having a high-grade mineral base, and not more than 3 to 4% of animal fats.

HYDRO VOLUME AND PRESSURE RECORDERS, containing information, with charts, on the measurement of the flow and pressure of gases, are the subject of a catalogue sent out by Herman Bacharach, Pittsburgh, Pa. In addition to a description to the various types of apparatus, which are primarily for use in securing economical plant operation, the text takes up a presentation of the principles of the Venturi tube, simple throttle disc, nozzle and Pitot tube, diagrams being used to illustrate the action of the fluid with each form. Velocity charts are also included, by which the velocity of gases of any specific gravity or temperature can easily be determined. Size 6x9 in. Pp. 16.

MEYER'S IMPROVED TUBE BLOWER, a new flue or soot blower for horizontal tubular boilers, is shown in printed matter being sent out by the Key Tube Blower Co., 21 Park Row, New York. It operates from the rear of the boiler, thus acting with the natural draft through the fire tubes. The Key tube blower, which is the invention of D. M. Meyers, New York, is withdrawn from the setting when not in use. In this way it is in no danger of deteriorating from the action of the hot gases. It is designed so that each individual boiler tube receives a single powerful jet of steam at its exact center. With one blower of this type, it is stated, a battery of boilers may be cleaned, provided the tube spacing on all boilers is the same.

SIPHONAGE PRINCIPLE OF VENTILATING BUILDINGS is the title of an article prepared by the Kernchen Co., Chicago, Ill., calling special attention to the Kernchen siphonage ventilator. This apparatus, which is of the automatic type, is described as a decided de-



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

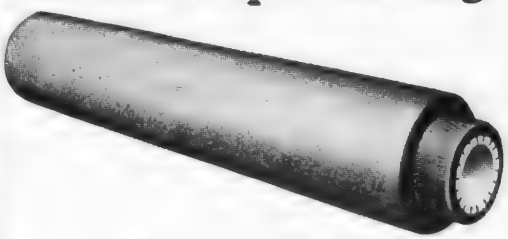
Not affected by wet and dry conditions common to steampipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY

ELMIRA . . N. Y.

STANDARD
Steam Pipe Casing



Above cut illustrates the completion of our tin lined

STEAM PIPE CASING

We also make unlined casing.

FOR

Insulating Underground Steam Pipes

Write for CATALOG and PRICES.
We furnish all SPECIALS required.

Standard Wood Pipe Co.
Williamsport, Penna.

WHY WASTE STEAM?

After steam has passed through the engine, says T. J. Coughlan, steam heating expert, approximately 1000 heat units per pound can be obtained from it.

Then why waste it through the exhaust—why not convey exhaust steam through

J-M Sectional Conduit after ten years' service

J-M SECTIONAL CONDUIT

—and heat buildings located up to thousands of feet from central power or heating plant without extra cost? The saving pays for the conduit within a very short time.

Does away with separate heating plants in each building, with all the additional labor, fuel, basement space, fire insurance, dirt, noise, etc. Makes it possible to burn cheaper coal and less coal.

Write nearest Branch for Catalog No. 112, giving full details.

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Boiler Copings and Foundation Caps for Motors, Pumps, Fans and Blowers

Estimates Furnished on Blueprints

Stone Shipped to All Points

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NORTH RIVER BLUE STONE
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Dixon's Graphite
PIPE JOINT COMPOUND

Makes tight joints with little effort, for steam, water, air, gas, oil, brine or any other piping.

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Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Co.

Established 1827

Multiple Roller Expansion Bearings, One of the Many Exclusive Features of RIC-WIL Method of Insulating Underground Pipes

Malleable iron guide with pockets which support a steel spindle, on which BRASS ROLLERS—RUST PROOF—are always free to turn. Lugs are provided which penetrate the DIATOMITE insulation which is INTEGRAL with the vitrified conduit to insure against any lateral movement of the bearing.

Catalog explaining our many other features yours on request.

RIC-WIL UNDERGROUND PIPE COVERING CO.

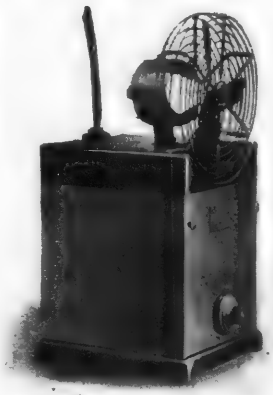
623 New England Bldg.,
CLEVELAND, - - - - - - - OHIO

parture from the old-fashioned type, being sensitive to the most delicate outside air currents. The announcement is made that a booklet issued by the company, entitled "It Pulls," describes in detail the principle embodied in this device.

LENNOX SERPENTINE SHEAR, a new type of machine being offered by Joseph T. Ryerson & Son, Chicago, Ill., is described in recently issued circular matter, showing the unique features of this device, one of them being that it is designed to cut in-and-out curves and even a circle with a radius very near that of the blade itself. All gears have teeth cut from solid metal and are provided with cast-iron gear guards, so that the workman is fully protected while operating the machine. The machine is driven by means of a two-speed pulley, giving slow speed for intricate curve cutting and high speed for straight work. The main drive shaft is extended and squared on one end so that a hand crank may be used if power is not available. The shear, it is stated, will reduce cutting costs fully one-half by replacing old-style hand and power cutters, and thus saving time and labor in handling. The shear illustrated has a capacity for cutting No. 10 gauge material and lighter, while other sizes having capacities of No. 16 gauge, ¼-in. and ⅜-in. material can be furnished. All machines are arranged for either belt and hand power or direct motor drive.

STANDARD STEAM PIPE CASING, for insulating underground steam pipes, are brought to the attention of the trade in a well-arranged circular published by the manufacturers, the Standard Wood Pipe Co., Williamsport, Pa. The lumber used in this product is white pine and the length of the casing is made up from 6 ft. up to 12 ft. The thickness of the stave varies according to the length, a table being included in the table giving the data as to sizes, etc. The circular also shows the pipe guides used to hold the iron pipe concentric with the wood casing, at the same time taking care of the expansion in the wood casing. These are also made in different sizes to fit the pipe. Another table and chart shows the various sizes of galvanized wire used for wrapping Standard steam pipe casings. The circular states that the company also manufactures wood water pipe and those interested can obtain the company's general catalogue upon request. Size 5½ x 9¼ in. Pp. 4.

ELIMINATE FOUL ODORS



No complaints in crowded rooms, banks, restaurants or factories where

Sprague Electric Ozonators Are In Use

Descriptive Bulletin A 83 will prove extremely valuable to all ventilating engineers. A copy sent on request.

SPRAGUE ELECTRIC WORKS
OF GENERAL ELECTRIC COMPANY
Main Office, 527-531 W. 34th Street
New York, N. Y.
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H.P. Equipment

Spencer Turbine Vacuum Cleaners
are manufactured in sizes from ¾ H. P. to 40 H. P.
Send for catalogue
SPENCER TURBINE CLEANER COMPANY
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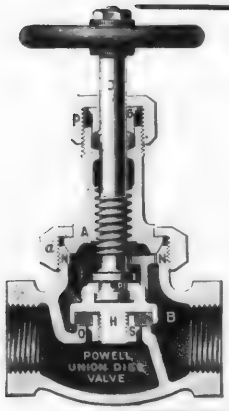
Your Choice of Seven Types
is offered in our line of
Standard Recording Thermometers
We make a specialty of hot water and steam indicators
Send for Catalogue VII
Standard Thermometer Co., Clifton and Shirley Sts., Boston, Mass.



POWELL VALVES

FOR HOT WATER OR STEAM HEATING

Five Points of Efficiency Combined in the POWELL Union Composite Disc Valves

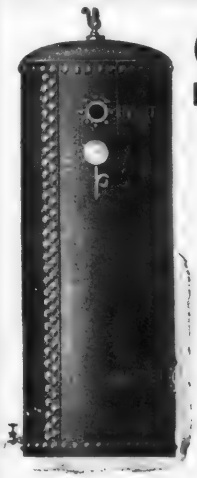
1. Body symmetrically designed and well-proportioned. 2. Metal distributed to meet most wear. 3. Union bevel ground joint connection between body and bonnet, red lead or cement unnecessary to make them tight. 4. Disc-holder "H" permits the use of any make of rubber discs. 5. All parts made to gauge and are interchangeable.

Ask your dealer for "POWELL" VALVES or write us.

THE WM POWELL CO.

DEPENDABLE ENGINEERING SPECIALTIES

CINCINNATI, O.



STEEL TANKS

For All Purposes

Riveted Tanks
Welded Tanks
Brazed Tanks

Founded 1802- -112 Years Old

Wm. B. Scaife & Sons Co.

NEW YORK OFFICE
26 Cortlandt Street

Pittsburgh, Pa.

Jolly Up "Slats"

This heating game isn't a game at all—if you get **started right,** with the **right system.**

Follow "Shifty." He got the right hunch. And the way it all happened is this. Shifty was a good contractor, but he had some old fashioned steam or hot water system in his kit. It didn't take him very long to wise up the fact that kicks were coming in on his jobs. That no matter how careful he was, kicks kept on coming in—because he nor any other contractor could with ordinary steam or hot water heating, deliver the results that are expected nowadays.

"Shifty" in looking around for something better hit on the

MOLINE SYSTEM OF HEATING

The Moline people gave him facts, real proof of Moline superiority. They told him straight from the shoulder just why Vapor Heating by the Moline System is the one real warming proposition on the market. Better for users because they get more warmth with less cost; better for the contractor because with it he's got the shade on every competition when it comes to a show-down of quality.

(Signed) THE MAN WHO KNOWS.

Send a postal today for the FACTS we've got for you.

Moline Vacuum Vapor Heating Co.
Dept. P. Moline, Ill.

BETWEEN THE TWO COVERS OF

Scientific Building Operation

you will find a half hundred articles written by the best authorities on building management in this country. Here are some of the subjects:

RENTING—ACCOUNTING—REPORTS—OPERATION METHODS—OPERATING COSTS
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Our special price to subscribers of **Buildings** and Building Management is $2.00 delivered to you. Otherwise, $2.50. **Buildings** and Building Management for one year and Scientific Building Operation, $4.00.

PATTERSON PUBLISHING CO., 918 City Hall Square Building, Chicago

TWENTY YEARS OF METAL WEATHER STRIPS is the title of an attractively gotten up catalogue published by the Chamberlin Metal Weather Strip Co., Detroit, Mich. The various types of this form of weather strip are shown in broken views of typical installations, the different parts illustrated including the looped tongue, the corrugated side strips, and meeting rail. A view is shown of the method of equipping bowed windows and the point is made that the Chamberlin metal weather strips can be adapted to any kind of window or door. The catalogue also contains a number of other types of weather sripping tried and used by the company with explanations of their strong and weak features. The catalogue concludes with the interesting statement that over 10,000,000 windows are equipped with Chamberlin weather stripe. Size 4x9 in. Pp. 16. In connection with the subject of window leakage the following terse summing up of the matter is submitted by H. W. Whitten, of the Boston branch of the Chamberlin Metal Weather Strip Co.:

"Distributors of heat find that wind uses up as much coal as does falling temperature.

"One mile of wind per hour equals 1° F. drop in temperature.

"Equip the building with Chamberlin and wind is reduced to 4-10° F. drop.

"Average wind velocity in New York, 15 miles per hour.

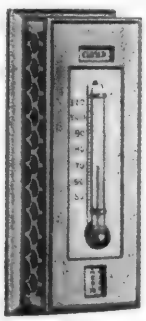
"Use Chamberlin and thereby move to a climate 9° warmer."

J-M POWER EXPERT for August, 1914, published by the Cleveland branch of the H. W. Johns-Manville Co., has pictures of the power plant in the Eleemosynary Institution, St. Louis, Mo.; refrigerator machinery room in the Armour & Co. plant, Chicago; power plant of the Duquesne Light Co., Rankin, Pa.; engine room of the M. C. R. R. Terminal, Detroit; and view of the Quarry Street Power Station of the Commonwealth Edison Co., Chicago, in all of which J-M insulating materials were used.

Wanted.

Wanted—Correspondence solicited with a good heating engineer salesman, one who has had experience in selling heating and ventilating systems on merit, not price; a good correspondent, with some ability to lay out work and willing to go anywhere; no fancy salary to start with, but good opportunity for right man. Give references, age and experience. Address Reliable, care of Heating and Ventilating Magazine.

Johnson Model Thermostat



OFFICE STYLE WITH INDICATOR AND SHUT-OFF

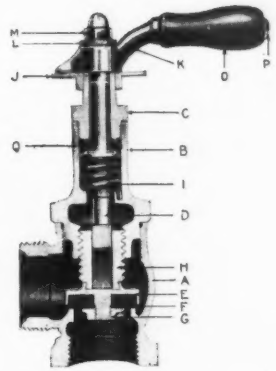
only four and three-quarter inches long, two inches wide and one inch deep, copied from the design of one of the greatest architects in the country, with the "Open and Closed" INDICATOR to show when the heat is turned "On" or "Off" and a POSITIVE SHUT-OFF for fresh air sleeping rooms. It is the final touch to an ideal heating system.

Write for Booklet.

Johnson Service Company

MILWAUKEE, WISCONSIN

NOTICE—We are the owners of Patent No. 924,235 relating to the automatic control of humidity. Infringers and unlicensed users will be prosecuted.



Style No. 32

A—Body
B—Bonnet
C—Top
D—Stem
E—Disc Holder
F—Disc
G—Disc Nut
H—Disc Carrier
I —Spring
J —Dial Plate
K—Lever
L—Stem Nut
M—Stem Lock Nut
O—Wood Handle
P—Screw
Q—Stem Steam Seat

IS IT WORTH WHILE?

Most people unconsciously ask this question of themselves when they are considering the use of an article they are not very familiar with, and, ten chances to one, it will go unanswered unless some one forces them to make a decision.

This cut sectional view of the

SYRACUSE PACKLESS RADIATOR VALVE

with graduated dial and lever handle will enable you to see at the first glance the SIMPLICITY of its construction and the well proportioned body metal lines.

You will be further interested to know that we will send you

A CUT SAMPLE postpaid for your careful examination. Give us your answer promptly.

ARCHITECTS, SEE SWEET'S, PAGE 1227

CONTRACTORS / OWNERS } *Send for "Inside Information on The Syracuse Packless Radiator Valve"* { IT'S FREE

SYRACUSE FAUCET AND VALVE CO., SYRACUSE, NEW YORK

N. Y. OFFICE, 220-224 West 42nd St. GEO. A. WELD CO., 79 Milk St., BOSTON

The Aristocrat

Good breeding is a thing which everyone, no matter what their station, universally admires. A good-looking, correctly groomed and efficient horse is an animal behind whom we all like to ride. It takes many generations to produce a horse of good breeding, and the same applies to merchandise.

Mechanical goods can show the marks of good breeding;—good breeding meaning correct design, shapely appearance and efficient action. A thoroughbred horse is of much more value than a scrub and the same is true of articles made of high-grade materials, by men who understand their business.

We claim that the

LAVIGNE PACKLESS QUICK-OPENING STEAM RADIATOR VALVE

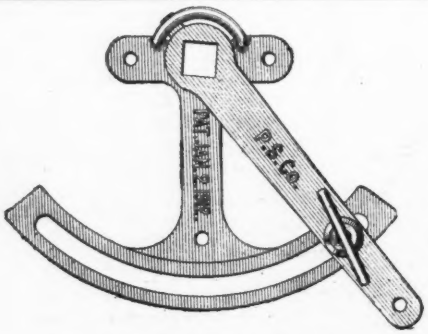
is the aristocrat of the valve business. It has taken years of experiment and many changes to produce the perfect product, but its shapely lines, uniformly accurate and efficient performance proclaim it the thoroughbred valve whose connection with any radiator enhances the beauty and appearance of the whole job.

We Can Prove Its Efficiency—You Can See Its Pure Lines—
We Want You to Try It on Your Heating Jobs

It is not an experiment—It is not a freak—It is successful—It opens and closes quickly—It positively does not leak air, water or steam—It is shapely in appearance—It is the pioneer packless valve design—costs but little more than ordinary valves.

Ask your Jobber for Details

LAVIGNE MANUFACTURING CO., Detroit, Mich.



"Furnish and install in all heat and vent flues, adjustable Dampers equipped with Parker Damper Quadrants (manufactured by the Parker Supply Company, 515 West 45th Street, New York), which permit of the Dampers being held in any desired position."

100% damper regulating efficiency will be yours if you make the above a part of your Damper Specifications. For

PARKER'S DAMPER QUADRANT

is conceded by many to be the one perfect and practical device for controlling dampers and deflectors.

Two parts—lever and frame—is all it has. And the lever locks right onto the frame, obviating the need of drilling and the use of pins, springs, nuts, etc. Result: a better, neater, simpler job.

Used in such buildings as the Woolworth, Municipal and Hudson Terminal in New York; Bellevue-Stratford Hotel in Philadelphia; Technical High School in Jersey City; Bureau of Engraving and Printing Building in Washington, and scores of others as prominent.

Let us send you a booklet which gives prices, sizes, etc.

PARKER SUPPLY COMPANY

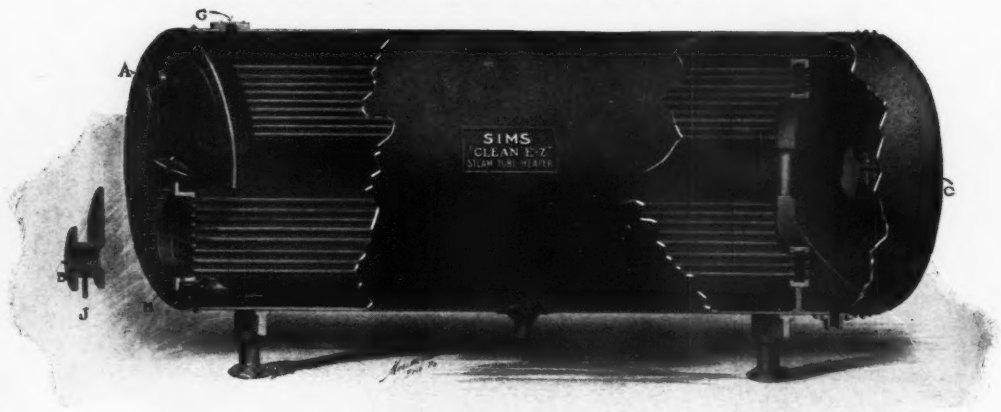
Manufacturers of Engineers' and Sheet-Metal Workers' Specialties

515 West 45th Street, NEW YORK

HAVE YOU A PROBLEM—

Involving the supply of large quantities of water at a given temperature?

HERE IS THE ANSWER—



"Sims" Standard Clean E-Z Heater

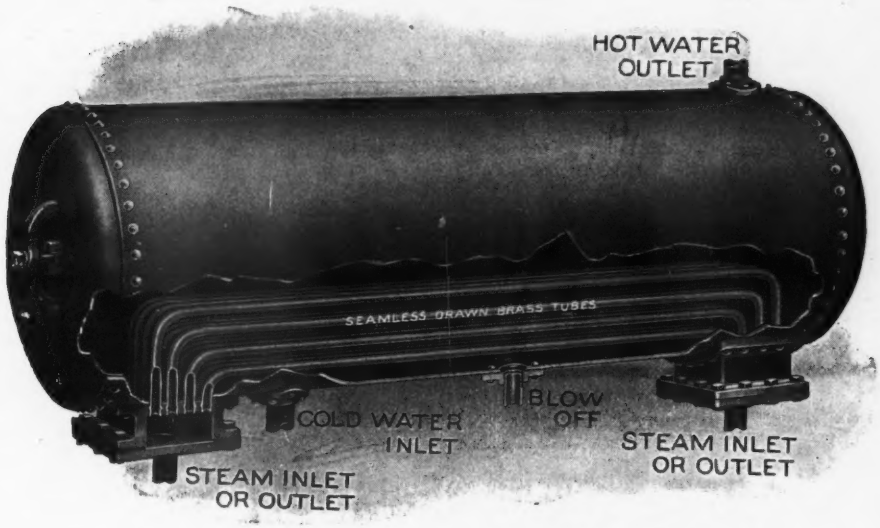
Patented

Ideal for laundries, hotels, hospitals and Y. M. C. A. and similar buildings.

Can Be Used With Live or Exhaust Steam as the Heating Medium

Send for Bulletin L-2, containing particulars.

THE SIMS COMPANY, ERIE, PA., 18th St.



Patented Aug. 26, 1913

TYPE C

THERE IS NO IDLE HEATING SURFACE
IN THE

PATTERSON
HOT WATER TANK

for heating water for domestic or manufacturing purposes

When steam enters the **Expansion Chamber,** it expands and uniformly fills the tubes, whose combined cross-sectional area is several times that of the steam pipe. As rapidly as the steam condenses, due to transmitting its heat to the surrounding water, it is discharged into the **Condensation Chamber.**

The Condensation Chamber has sufficient area to provide for any sudden increase of condensation without permitting it to back up into the tubes to destroy their heating efficiency.

The heating surface in the Patterson Tank consists of a number of parallel seamless drawn brass tubes, both ends of each being expanded into heavy cast iron tube-heads with an improved roller expander. Their ⌐ shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.

Any combination of storage and heating capacities can be furnished.

FRANK PATTERSON & CO.

26 CORTLANDT STREET, NEW YORK

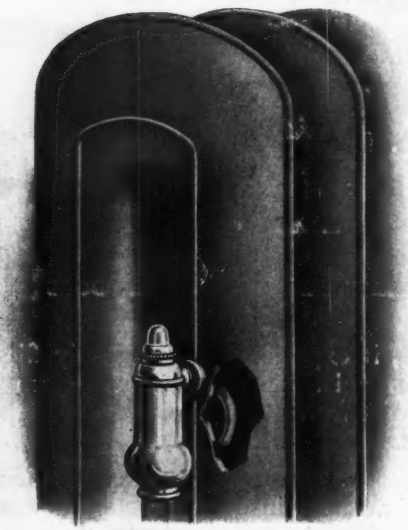
Representatives in All Principal Cities

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

There are no "Ifs" to the Norwall

"If I had put in those Norwall Siphon Air Valves, I should already have been spared the cost of that new ceiling." The owner of a fine apartment building made that remark the other day. Also, *if* the valves he did put in had been properly adjusted, *if* they had not sputtered steam and leaked water, *if* the tenant could not possibly have tampered with them, the owner might have been spared the cost of that new ceiling. That's just the point. There are no *ifs* and *ands* about the

Norwall Siphon Air Valve



The Norwall Siphon Air Valve is made entirely of metal. It is a float type valve, operated by the expansion and contraction of the most responsive and flexible agent ever employed for this purpose—air. The Siphon shown in the cutaway always keeps valve free of water.

These valves are positive and never-failing in their action, closing instantly when steam or water reaches the valve and opening to let out the smallest air pocket. They are absolutely non-adjustable — cannot be tampered with. They are ready to work the minute they are put on the job, and they always work just the same, — never require attention. Installing Norwall Siphon Air Valves not only furnishes the owner good household insurance, it means added profit and prestige to the steamfitter.

AMERICAN RADIATOR COMPANY

Chicago, New York, Boston, Providence, Philadelphia, Baltimore, Buffalo, Washington, Pittsburgh, Cleveland, Cincinnat Detroit, Atlanta, Birmingham, New Orleans, Indianapolis, Milwaukee, Omaha, Minneapolis, St. Paul, St. Louis, Kansas City, Denver, San Francisco, Los Angeles, Portland, Seattle, Spokane, Brantford (Ont.), London, Brussels, Paris, Berlin, Cologne, Vienna, Milan